National Law Enforcement and Corrections Technology Center

Equipment Performance Report: 1999 Patrol Vehicle Tires

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U.S. Department of Justice
Office of Justice Programs
National Institute of Justice

Equipment Performance Report: 1999 Patrol Vehicle Tires

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National Institute of Justice

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Director

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The National Institute of Justice is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance, the Bureau of Justice Statistics, the Office of Juvenile Justice and Delinquency Prevention, and the Office for Victims of Crime.

Preface

The National Institute of Justice's National Law Enforcement and Corrections Technology Center (NLECTC) is pleased to present the results of its third, biennial comprehensive evaluation of patrol vehicle tires. When the project was first visualized, the goal was to provide law enforcement agencies across the country with information that would help them make more informed decisions about which tires would be best for their patrol vehicle fleets.

This report contains a large amount of data generated throughout the evaluation, which was conducted under a variety of test conditions. Score sheets compare the tires' performance in various categories but do not identify any overall "winner" or "loser." Because driving conditions in different parts of the country vary so widely, individual agencies are left with the task of identifying the most suitable tires for their patrol vehicles based on their own driving conditions and needs. It is important that agencies place the appropriate weight on those portions of the test data most representative of the conditions they may encounter. For example, the tire that best meets the needs of a law enforcement agency in the desert Southwest, which has much more dry than wet weather, may be different than what would be best for an agency in the Pacific Northwest, where wet weather is more the norm. In addition, the most suitable tire may also depend on the make and model of the patrol vehicle—the best tire for use on the rear-wheel-drive Ford Police Interceptor may be different from the best tire for the new front-wheel-drive Chevrolet Impala.

The major manufacturers of police tires were asked to participate and submit samples of tires for evaluation. Three companies donated tires for testing. The three tire brands tested were Firestone, General, and Goodyear.

Each brand of tire was tested on two vehicles: a 1999 Ford Police Interceptor and a 2000 Chevrolet Impala. The Ford Police Interceptor was selected for use in this test because it represents the largest number of current police cars, and will, we believe, continue to be in widespread usage over the next 2 to 3 years. The Chevrolet Impala, which is to be introduced in it's "police package" configuration later this year, was chosen because it promises to be a major contender in the law enforcement market, and will most likely fill the gap left by the discontinuation of the Chevrolet Caprice in 1996.

The following tire models were tested:

Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A

While the size of all of the test tires was the same, P225/60R–16, the load/speed ratings were different for the various brands and models tested. Please consult the Police Tire Descriptions on pages 3 and 4 of this report for complete information about each of the tires tested.

Each of the test procedures is described as completely as possible in the test report. In the dry serpentine and stopping distance tests the pavement surface of the test course was common asphalt with a section of concrete with a coefficient of friction typical of many public roads. The wet stopping distance and serpentine tests were also conducted on a common asphalt surface which was wetted down using a sprinkling system. This resulted in a *wet* pavement surface, but without any significant standing water. The dry and wet static circle tests were conducted on a polished concrete surface with a low coefficient of friction. This test surface, when wet, had a constant 3/8 inch to 1/2 inch of standing water and provided a good test of the ability of the various tires to resist hydroplaning and stay in contact with the pavement.

The results presented in this report were calculated on a computer spreadsheet program with an infinite number of decimal places. Some calculations made on an adding machine or calculator will result in slightly different totals.

Acknowledgments

This third comprehensive evaluation of patrol vehicle tires is the result of a recommendation made a number of years ago by the Law Enforcement and Corrections Advisory Council (LECTAC). LECTAC consists of criminal justice officials from Federal, State, and local agencies who assess equipment needs and set priorities for developing equipment standards, guides, test reports, and other publications. The Council felt that periodic evaluations of police tires were crucial to addressing the informational needs of law enforcement agencies in procuring equipment critical to the operation of their patrol vehicle fleets. It is hoped that this evaluation will assist the agencies to select, in a cost-effective manner, the best tires for their fleets.

The National Institute of Justice's National Law Enforcement and Corrections Technology Center (NLECTC) thanks the Federal Law Enforcement Training Center (FLETC) in Glynco, Georgia, both for its assistance in preparation and logistical support for this evaluation, and for the use of its Range 7 road course for the high-speed handling portion of the tests.

NLECTC would also like to thank the St. Augustine Technical Center (SATC) for providing a test facility in St. Augustine, Florida, that was well equipped to meet the needs for this evaluation, and for the much needed assistance so willingly provided by SATC personnel during the testing process.

Our thanks goes as well to the LucasVarity Corporation and its personnel for use of portions of its facility at Green Cove Springs, Florida. Their cooperation has allowed us to produce more reliable wet pavement test data.

We also express our appreciation to The Tire Rack in South Bend, Indiana, for allowing us to use the text and illustrations from their World Wide Web site for the Technical Information pages in this report.

NLECTC thanks the Ford Motor Company and the Chevrolet Division of General Motors Corporation for the use of "police package" cars and police wheels for this evaluation. The companies that submitted the tires for testing deserve recognition and thanks as well: Bridgestone/Firestone, Inc.; General Tire Company; and Goodyear Tire and Rubber Company.

About the National Institute of Justice

The National Institute of Justice (NIJ), a component of the Office of Justice Programs, is the research agency of the U.S. Department of Justice. Created by the Omnibus Crime Control and Safe Streets Act of 1968, as amended, NIJ is authorized to support research, evaluation, and demonstration programs, development of technology, and both national and international information dissemination. Specific mandates of the Act direct NIJ to:

- Sponsor special projects and research and development programs that will improve and strengthen the criminal justice system and reduce or prevent crime.
- Conduct national demonstration projects that employ innovative or promising approaches for improving criminal justice.
- Develop new technologies to fight crime and improve criminal justice.
- Evaluate the effectiveness of criminal justice programs and identify programs that promise to be successful if continued or repeated.
- Recommend actions that can be taken by Federal, State, and local governments as well as by private organizations to improve criminal justice.
- Carry out research on criminal behavior.
- Develop new methods of crime prevention and reduction of crime and delinquency.

In recent years, NIJ has greatly expanded its initiatives, the result of the Violent Crime Control and Law Enforcement Act of 1994 (the Crime Act), partnerships with other Federal agencies and private foundations, advances in technology, and a new international focus. Some examples of these new initiatives:

- New research and evaluation is exploring key issues in community policing, violence against women, sentencing reforms, and specialized courts such as drug courts.
- Dual-use technologies are being developed to support national defense and local law enforcement needs.
- Four regional National Law Enforcement and Corrections Technology Centers (NLECTC), a Border Research and Technology Center, and three special offices have joined the National Center in Rockville, Maryland, to form the NLECTC system.
- The causes, treatment, and prevention of violence against women and violence within the family are being investigated in cooperation with several agencies of the U.S. Department of Health and Human Services.
- NIJ's links with the international community are being strengthened through membership in the United Nations network of criminological institutes; participation in developing the U.N. Criminal Justice Information Network; initiation of UNOJUST (U.N. Online Justice Clearinghouse), which electronically links the institutes to the U.N. network; and establishment of an NIJ International Center.
- The NIJ-administered criminal justice information clearinghouse, the world's largest, has improved its online capability.
- The Institute's Drug Use Forecasting (DUF) program has been expanded and enhanced. Renamed ADAM (Arrestee Drug Abuse Monitoring), the program will increase the number of drug-testing sites, and its role as a "platform" for studying drug-related crime will grow.
- NIJ's new Crime Mapping Research Center will provide training in computer mapping technology, collect and archive geocoded crime data, and develop analytic software.
- The Institute's program of intramural research has been expanded and enhanced.

The Institute Director, who is appointed by the President and confirmed by the Senate, establishes the Institute's objectives, guided by the priorities of the Office of Justice Programs, the Department of Justice, and the needs of the criminal justice field. The Institute actively solicits the views of criminal justice professionals and researchers in the continuing search for answers that inform public policymaking in crime and justice.

About the Law Enforcement Standards and Testing Program

The Law Enforcement Standards and Testing Program is sponsored by the Office of Science and Technology of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which created NIJ and directed it to encourage research and development to improve the criminal justice system and to disseminate the results to Federal, State, and local agencies.

The Law Enforcement Standards and Testing Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationwide and internationally.

The program operates through the following:

- The **Law Enforcement and Corrections Technology Advisory Council** (LECTAC), consisting of nationally recognized criminal justice practitioners from Federal, State, and local agencies, assesses technological needs and sets priorities for research programs and items to be evaluated and tested.
- The **Office of Law Enforcement Standards** (OLES) at the National Institute of Standards and Technology develops voluntary national performance standards for compliance testing to ensure that individual items of equipment are suitable for use by criminal justice agencies. The equipment standards developed by OLES are based upon laboratory evaluation of commercially available products in order to devise precise test methods that can be universally applied by any qualified testing laboratory and to establish minimum performance requirements for each attribute of a piece of equipment that is essential to how it functions. OLES-developed standards can serve as design criteria for manufacturers or as the basis for equipment evaluation. The application of the standards, which are highly technical in nature, is augmented through the publication of technical reports and user guides. Individual jurisdictions may use the standards in their own laboratories to test equipment, have equipment tested on their behalf using the standards, or cite the standards in procurement specifications.
- The **National Law Enforcement and Corrections Technology Center** (NLECTC), operated by a grantee, supervises a national compliance testing program conducted by independent laboratories. The standards developed by OLES serve as performance benchmarks against which commercial equipment is measured. The facilities, personnel, and testing capabilities of the independent laboratories are evaluated by OLES prior to testing each item of equipment. In addition, OLES helps NLECTC staff review and analyze data. Test results are published in consumer product reports designed to help justice system procurement officials make informed purchasing decisions.

Publications are available at no charge through the National Law Enforcement and Corrections Technology Center. Some documents are also available online through the Internet/World Wide Web. To request a document or additional information, call 800–248–2742 or 301–519–5060, or write:

National Law Enforcement and Corrections Technology Center
P.O. Box 1160
Rockville, MD 20849–1160

E-mail: *asknlectc@nlectc.org*

World Wide Web address: *http://www.nlectc.org*

About the National Law Enforcement and Corrections Technology Center System

The National Institute of Justice (NIJ), responding to recommendations by the law enforcement and corrections community, converted its Technology Assessment Program Information Center (TAPIC) into the National Law Enforcement and Corrections Technology Center (NLECTC), which is composed of the national center, four regional centers, the Border Research and Technology Center, the Office of Law Enforcement Standards (OLES), and the Office of Law Enforcement Technology Commercialization (OLETC). The National Center for Forensic Science (NCFS), the newest addition to the NLECTC system, initially will focus on arson and explosives research.

These facilities are part of a law enforcement and corrections information network that will make it easier for agencies and departments to locate new products and for industry to identify law enforcement and corrections requirements.

NLECTC's major responsibilities and goals are:

- To work with OLES to establish voluntary standards for selected law enforcement equipment and manage voluntary compliance testing programs.
- To develop critical product databases for law enforcement and corrections that include information such as who manufactures what, what the points of contact are, what testing or evaluation information is available, and what other law enforcement agencies use the product and can discuss its effectiveness.
- To assist law enforcement in understanding what technologies are available, how they can be used, and what advantages they offer.
- To evaluate products, such as body armor, firearms, vehicle tires, and handcuffs.
- To conduct field demonstrations of new law enforcement and corrections technologies.
- To collect law enforcement and corrections needs and requirements information for use by industry to develop affordable technologies for law enforcement and corrections.
- To disseminate information about its resources and services through newsletters, product bulletins, consumer product lists, articles in criminal justice periodicals, exhibits and presentations at criminal justice conferences, and online access.
- To coordinate the Law Enforcement and Corrections Technology Advisory Council (LECTAC), which is composed of nationally recognized professionals from Federal, State, and local criminal justice and corrections agencies. LECTAC helps NIJ set priorities for developing new equipment standards, for testing available products, and for establishing future program initiatives for NLECTC.

To receive more information or to add your name to the NLECTC mailing list, call 800–248–2742 or 301–519–5060, or write:

National Law Enforcement and Corrections Technology Center
P.O. Box 1160
Rockville, MD 20849–1160

E-mail: *asknlectc@nlectc.org*

World Wide Web address: *http://www.nlectc.org*

About the National Law Enforcement and Corrections Technology Center System

The following is a list of NLECTC regional and affiliated facilities that assist NIJ in fulfilling its mission:

NLECTC–Northeast
26 Electronic Parkway
Rome, NY 13441–4514
(p) 888–338–0584
(f) 315–330–4315
E-mail: *nlectc_ne@rl.af.mil*

NLECTC–Southeast
5300 International Boulevard
North Charleston, SC 29418
(p) 800–292–4385
(f) 843–760–4611
E-mail: *nlectc-se@nlectc-se.org*

NLECTC–Rocky Mountain
2050 East Iliff Avenue
Denver, CO 80208
(p) 800–416–8086
(f) 303–871–2500
E-mail: *nlectc@du.edu*

NLECTC–West
c/o The Aerospace Corporation
2350 East El Segundo Boulevard
El Segundo, CA 90245–4691
(p) 888–548–1618
(f) 310–336–2227
E-mail: *nlectc@law-west.org*

Border Research and Technology Center
225 Broadway
Suite 740
San Diego, CA 92101
(p) 619–232–1726 or 888–656–2782
(f) 619–232–1451 or 888–660–2782
E-mail: *brtcchrisa@aol.com*

Office of Law Enforcement Standards
100 Bureau Drive, Stop 8102
Gaithersburg, MD 20899–8102
(p) 301–975–2757
(f) 301–948–0978
E-mail: *oles@nist.gov*

Office of Law Enforcement Technology Commercialization
Wheeling Jesuit University
316 Washington Avenue
Wheeling, WV 26003
(p) 888–306–5382
(f) 304–243–2131
E-mail: *oletc@nttc.edu*

National Center for Forensic Science
University of Central Florida
P.O. Box 162367
Orlando, FL 32816–2367
(p) 407–823–6469
(f) 407–823–3162
E-mail: *natlctr@pegasus.cc.ucf.edu*

About the Office of Law Enforcement Standards

The Office of Law Enforcement Standards (OLES) was established as a matrix management organization in 1971 through a Memorandum of Understanding between the U.S. Departments of Justice and Commerce based upon the recommendations of the President's Commission on Crime. OLES' mission is to apply science and technology to the needs of the criminal justice community, including law enforcement, corrections, forensic science, and the fire service. While its major objective is to develop minimum performance standards, which are promulgated as voluntary national standards, OLES also undertakes studies leading to the publication of technical reports and user guides.

The areas of research investigated by OLES include clothing, communication systems, emergency equipment, investigative aids, protective equipment, security systems, vehicles, weapons, and analytical techniques and standard reference materials used by the forensic science community. The composition of OLES' projects varies depending upon priorities of the criminal justice community at any given time and, as necessary, draws upon the resources of the National Institute of Standards and Technology.

OLES assists law enforcement and criminal justice agencies in acquiring, on a cost-effective basis, the high-quality resources they need to do their jobs. To accomplish this, OLES:

- Develops methods for testing equipment performance and examining evidentiary materials.
- Develops standards for equipment and operating procedures.
- Develops standard reference materials.
- Performs other scientific and engineering research as required.

Since the program began in 1971, OLES has coordinated the development of nearly 200 standards, user guides, and advisory reports. Topics range from performance parameters of police patrol vehicles, to performance reports on various speed-measuring devices, to soft body armor testing, to analytical procedures for developing DNA profiles.

The application of technology to enhance the efficiency and effectiveness of the criminal justice community continues to increase. The proper adoption of the products resulting from emerging technologies and the assessment of performance of equipment, systems, methodologies, etc., used by criminal justice practitioners constitute critical issues having safety and legal ramifications. The consequences of inadequate equipment performance or inadequate test methods can range from inconvenient to catastrophic. In addition, these deficiencies can adversely affect the general population when they increase public safety costs, preclude arrest, or result in evidence found to be inadmissible in court.

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General Comments on Statistical Analysis

The statistical techniques used in these analyses were parametric in nature. As such, they assume a normally distributed underlying population. Although no tests for normality were done, there is no reason to believe that the data presented in this report should not follow such a distribution.

In all cases, the objective of the analysis was to determine if significant differences existed between two or more populations of measurements as represented by experimental sampling. Paired T-tests were used to assess the statistical differences between experimental observations. Independence of observations and equality of population variances were assumed.

In all cases, a 95-percent confidence limit was used to define significance.

Where the evaluation shows minor performance differences between the tires on a given test but analysis of the data indicates the differences are not statistically significant, a specific notation has been made on the overall score page for that test, and detailed explanations are given in the Appendix—Analysis to Determine Statistical Significance.

The Appendix was compiled by Carl Davis, who analyzed the data to determine their statistical significance.

Testing Equipment

The following test equipment was used in the static circle, stopping distance, serpentine, high-speed handling and treadwear portions of the evaluation program.

DATRON TECHNOLOGY, INC.
33533 West Twelve Mile Road, Suite 180
Farmington Hills, MI 48331
DLS Smart Sensor–Optical Noncontact Speed and Distance Sensor

CHRONOMIX CORPORATION
650F Vaqueros Avenue
Sunnyvale, CA 94086–3580
Compusport 737 Multi-Function Printing Timer

MICRO SWITCH
Division of Honeywell
Freeport, IL 61032
Modulated LED Control (photoelectric micro switch)
Model FE–MLS–3B

ALGE–TELESIGNAL TX/RX
Phoenix Sports Technology
1344 Route 100 S.
P.O. Box 774
Trexlertown, PA 18087
Alge Sports Timing Telesignal Transmitter—Model TX
Alge Sports Timing Telesignal Receiver—Model RX

BELL PRO POLICE
Box 927
Rantoul, IL 61866
Bell MC–500VBL76 Nascar Style Driving Helmets

MTI CORPORATION
965 Corporate Boulevard
Aurora, IL 60504
Mitutoyo Digital Tread Depth Gauge-Model 700–105

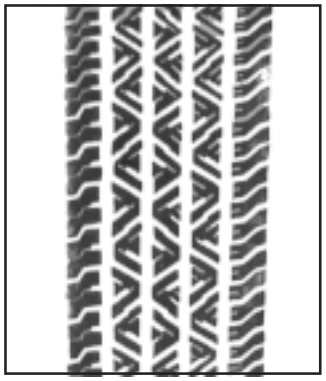
Police Tire Descriptions

Tested on the 2000 Chevrolet Impala

Firestone Firehawk PV41

P225/60R–16 97V M&S
Tread: 5 plies–2 Polyester, 2 Steel, 1 Nylon
Sidewall: 2 plies Polyester
Max Load: 1609 lbs. (730 kg)
Max Inflation: 44 psi (300 kpa)

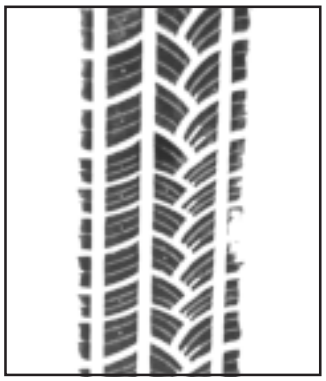
U.S. Government mandated ratings:		
	Treadwear	340
	Traction	A
	Temperature	A



General XP 2000 V4

P225/60R–16 98V M&S
Tread: 6 plies–2 Steel, 2 Polyester, 2 Nylon
Sidewall: 2 plies Polyester
Max Load: 1653 lbs. (750 kg)
Max Inflation: 44 psi (300 kpa)

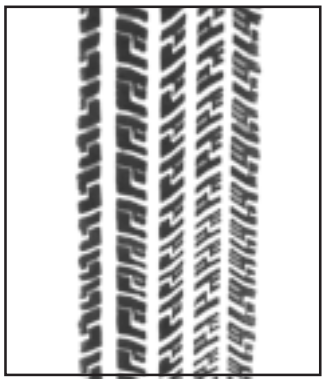
U.S. Government mandated ratings:		
	Treadwear	320
	Traction	A
	Temperature	A



Goodyear Eagle RS–A

P225/60R–16 97H M&S
Tread: 5 plies–2 Polyester, 2 Steel, 1 Nylon
Sidewall: 2 plies Polyester
Max Load: 1609 lbs. (730 kg)
Max Inflation: 44 psi (300 kpa)

U.S. Government mandated ratings:		
	Treadwear	260
	Traction	A
	Temperature	A



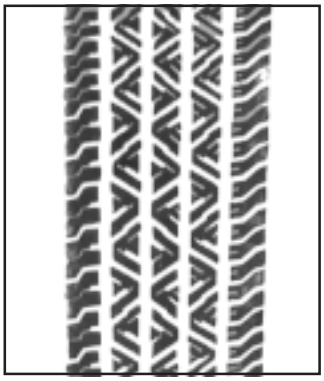
Police Tire Descriptions

Tested on the 1999 Ford Police Interceptor

Firestone Firehawk PV41

P225/60R–16 97V M&S
Tread: 5 plies–2 Polyester, 2 Steel, 1 Nylon
Sidewall: 2 plies Polyester
Max Load: 1609 lbs. (730 kg)
Max Inflation: 44 psi (300 kpa)

U.S. Government mandated ratings:		
	Treadwear	340
	Traction	A
	Temperature	A



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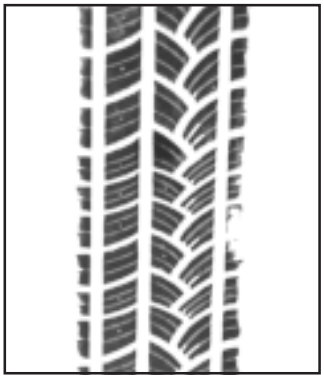

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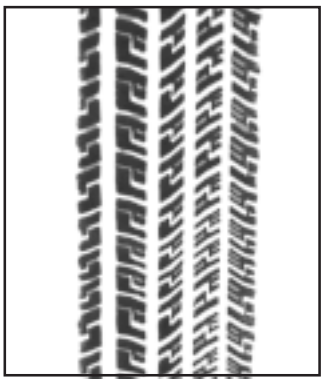
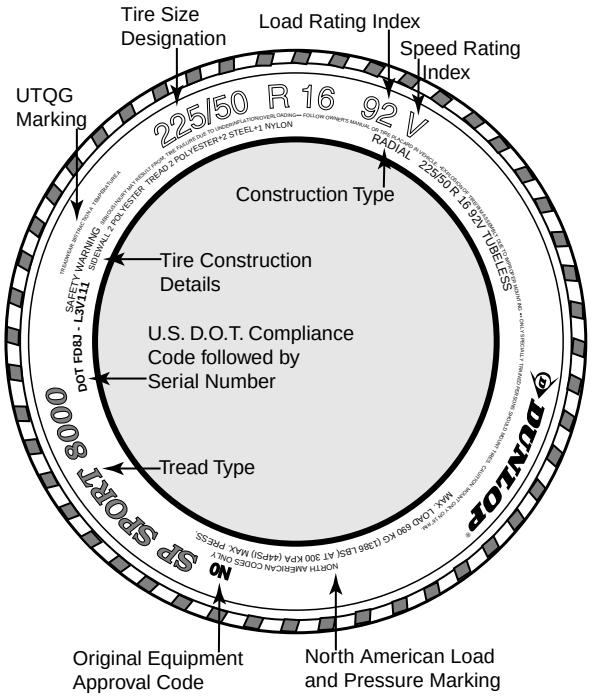


Sidewall Markings

There is a lot of information on the sidewall of a tire. Typically, you'll find UTQG ratings for treadwear traction, and temperature; the size of the tire; the load rating index number with the speed rating index; the construction type (bias or radial); the D.O.T. (Department of Transportation) compliance code; construction details; and, of course, the make and model of the tire. On some tires used as original equipment, you may also find a marking that indicates its OE status. Porsche uses an N-0 or N-1 designation, BMW uses a star on some OE tires, and General Motors uses a "TPC" code. Light truck tires are sometimes marked with an LT for "Light Truck" before the size, and passenger car tires are often marked with the letter P for "Passenger" before the size. Passenger tires of the same size with or without the P are virtually interchangeable.



UTQG Ratings

Uniform Tire Quality Grading

The Department of Transportation requires each manufacturer to grade its tires under the Uniform Tire Quality Grade (UTQG) labeling system and establish ratings for treadwear, traction, and temperature resistance. These tests are conducted independently by each manufacturer following government guidelines to assign values that represent a comparison between the tested tire and a control tire. While traction and temperature resistance ratings are specific performance levels, the treadwear ratings are assigned by the manufacturers following field testing and are most accurate when comparing tires of the same brand.

Treadwear

Treadwear receives a comparative rating based on wear rate of the tire in field testing following a government specified course. For example, a tire grade of 150 wears 1.5 times longer than a tire graded 100. Actual performance of the tire can vary significantly depending on conditions, driving habits, care, road characteristics, and climate.

Traction

Straight ahead wet braking traction has been represented by a grade of A, B, or C, with A being the highest. In 1997 a new top rating of "AA" was introduced to indicate even greater wet braking traction. However, due to its newness, this grade will probably be applied initially to new tire lines as they are introduced and later to existing lines that excel in wet braking, but had been limited to the previous top grade of "A." Traction grades do not indicate wet cornering ability.

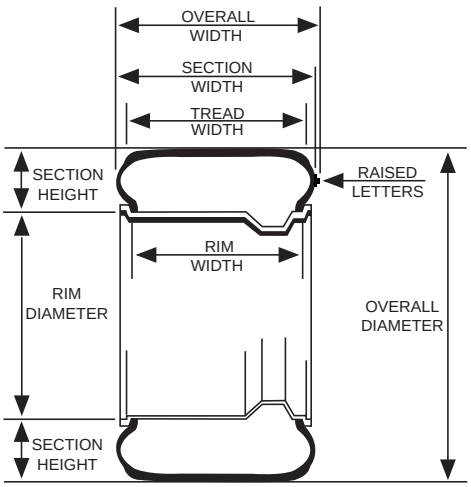
Temperature

Temperature resistance is graded A, B, or C. It represents the tires' resistance to the heat generated by running at high speed. Grade C is the minimum level of performance for all passenger car tires as set under Federal Motor Vehicle Safety Standards. This grade is established for a tire that is properly inflated and not overloaded.

Note: UTQG ratings are not required on winter and light truck size tires.

Tire Sizes Decoded

A typical tire sidewall size designation might read either as: **185/60R–14 85H** or **185/60HR–14.**



The first number is the width of the tire in millimeters, measured from sidewall to sidewall. To convert to inches, divide by 25.4. In the example above, the width is 185 mm, or 7.28 inches.

The second number is the aspect ratio. This is the ratio of sidewall height to width. In the example above, the tire is 7.28 inches wide. Multiply that by the aspect ratio to find the height of one sidewall. In this case, 185 mm x .60 = 111 mm or 7.28 inches x .60 = 4.36 inches.

The last number is the diameter of the wheel rim in inches.

To determine the outside diameter of a tire, take the sidewall height and multiply by 2, (remember that the diameter is made up of two sidewalls, the one above the wheel and the one below the wheel) and add the diameter of the wheel, to get your answer.

Example: 185 mm x .60 = 111 mm x 2 = 222 mm + 355.6 mm (14 inches) = 577.6 mm or 22.74 inches.

Load Ratings

Many tires come with a service description added on the end of the tire size. These service descriptions contain a number that is the load index, and a letter that indicates the speed rating. The load rating index represents the maximum load each tire is designed to support. Because the maximum tire load capacity is branded on the tire's sidewall, the load index table below may be used as a quick reference.

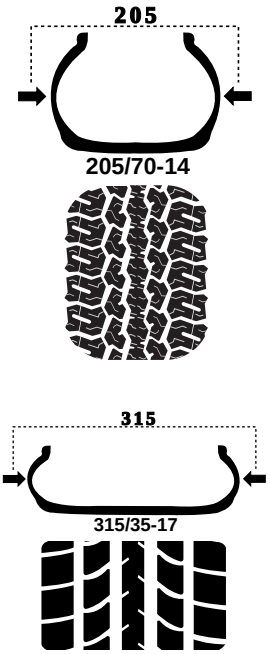
Load Index	Pounds	Kilograms	Load Index	Pounds	Kilograms	Load Index	Pounds	Kilograms
71	761	345	85	1135	515	99	1709	775
72	783	355	86	1168	530	100	1764	800
73	805	365	87	1201	545	101	1819	825
74	827	375	88	1235	560	102	1874	850
75	853	387	89	1279	580	103	1929	875
76	882	400	90	1323	600	104	1984	900
77	908	412	91	1356	615	105	2039	935
78	937	425	92	1389	630	106	2094	950
79	963	437	93	1433	650	107	2149	975
80	992	450	94	1477	670	108	2205	1000
81	1019	462	95	1521	690	109	2271	1030
82	1047	475	96	1565	710	110	2337	1060
83	1074	487	97	1609	730			
84	1102	500	98	1653	750			

Speed Ratings

Speed Ratings signify the safe top speed of a tire under **perfect** conditions. Common speed ratings are:

Q = 99 mph (160 km/h)
S = 112 mph (180 km/h)
T= 118 mph (190 km/h)
U = 124 mph (200 km/h)
H = 130 mph (210 km/h)
V = 149 mph (240 km/h)
W = 168 mph (270 km/h)
Y = 186 mph (300 km/h)
Z = 149 mph (240 km/h) and over

Tire Contact Patch

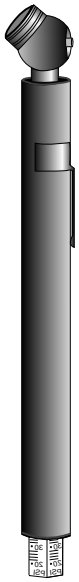


Picture yourself driving along the highway and the sports news comes on the radio. The announcer mentions Shaquille O'Neal. Now, that guy has pretty big feet, but does he put more rubber on the ground with his sneakers than your tires put on the road? Hard to believe, but Shaq puts more rubber down than most cars do. The contact patch of most tires is about the size of your hand, and has to handle a lot more weight and force than those big shoes do.

The shape of a tire's contact patch or "footprint" greatly influences its performance and is dependent on its profile or "aspect ratio." Low-profile tires (most performance tires) have a short and wide contact patch that is effective in converting the driver's input into very responsive handling, cornering stability, and traction—especially on dry roads.

High-profile tires (light truck and most passenger tires) have a long and narrow contact patch that helps to provide predictable handling, a smooth ride, and especially good traction in snow.

Air Pressure



Tires support the weight of your car, right? Actually, they don't. The air pressure inside the tire is what supports the car. The tire is basically just a container to put the air in. The correct air pressure is required for good handling, traction, and durability.

You cannot, however, just set it and forget it. In most parts of North America, fall and early winter months are the most critical times to check inflation pressures because the days are getting shorter and the temperatures colder. Since air is a gas, it contracts when cooled.

For every 10 degrees Fahrenheit the ambient temperature changes, your tire's inflation pressure will change by about 1 pound per square inch (psi). It will go down with lower temperatures, and up with higher temperatures. The typical difference between summer and winter temperatures is about 50 degrees F, which results in a loss of about 5 psi, and will sacrifice handling, traction, durability, and safety.

The tire pressure recommended in your vehicle's owners' manual or tire information sticker is a "cold" pressure, so the pressure should be checked in the morning before you drive the car more than a few miles. Also, if you park in a heated or attached garage, you will "lose" pressure when you leave its warmth and venture out into the cold. You may want to add 1 psi for each 10 degrees Fahrenheit difference between your garage temperature and the outside temperature to compensate.

Also keep in mind that tires tend to lose about 1 psi per month, so check them often.

The text (edited) and illustrations on the "Technical Information" pages were used courtesy of:

The Tire Rack
771 W. Chippewa Avenue
South Bend, IN 46614–3729
Phone: 888–541–1777 or 219–287–2345
Internet: **www.tirerack.com**

Static Circle Test
Dry Pavement Surface

Test Objective

Determine the road-holding performance characteristics of the test tires in a steady-state turning situation on a dry pavement surface. The course used has a flat polished concrete surface on which a circle has been created using pylons. The circle measures 200 feet in diameter and 628.3 feet in circumference. The driver is allowed 2 laps to accelerate and stabilize the vehicle at the highest speed possible while remaining within the marked lane. (See illustration below.) Once the vehicle is stabilized, the following 8 laps are timed, and the average of the timed laps is used to determine the final score for this portion of the evaluation, which is expressed in lateral "G" attained—lateral "G" being the measurement of the resistance of lateral movement before the tire loses adhesion and the vehicle begins to slip. Deficiencies in tire adhesion, or the tendency of the tire to slip sideways under hard, steady-state cornering maneuvers, will result in slower speeds, longer lap times, and a relatively lower overall score on this portion of the evaluation.

Test Methodology

Following a 2-lap tire warmup, each test vehicle equipped with the make and model of tire to be evaluated makes a minimum of 8 timed laps around the static circle course. The final score for each tire on this portion of the evaluation is the average of the 8 timed laps and is expressed as lateral "G" attained.

Formulas

To determine the lateral "G" attained, multiply pi times the diameter of the test circle and divide by the lap time. Square this quotient, and divide by the radius of the circle, and then divide by 1 G.

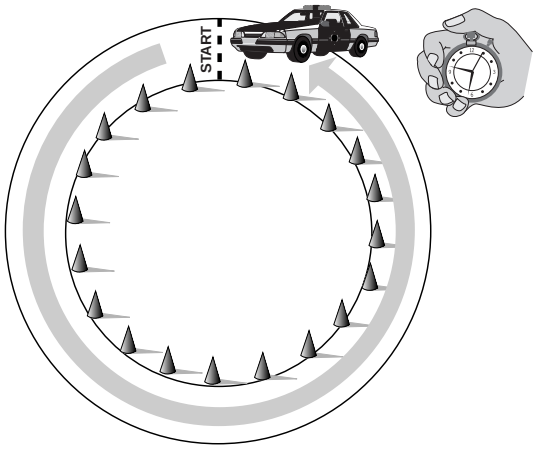
Example:

(3.14159 x 200 ft. ÷ lap time) x (3.14159 x 200 ÷ lap time) ÷ 100 ft. ÷ 32.2 ft./sec.
(pi) (diameter) (radius) (1 G)

To determine speed, divide the circumference of the test circle by the lap time, then divide by 1.4667 ft./sec.

Example:

628.3 ft. ÷ lap time ÷ 1.4667 ft./sec.



Test Data

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	13.706	31.26	0.653
2	13.607	31.48	0.662
3	13.589	31.52	0.664
4	13.413	31.94	0.681
5	13.440	31.87	0.679
6	13.381	32.01	0.685
7	13.684	31.31	0.655
8	13.472	31.80	0.676
Average	13.537	31.65	0.669
Final score (lateral "G")			**0.669**

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	13.467	31.81	0.676
2	13.490	31.76	0.674
3	13.446	31.86	0.678
4	13.588	31.53	0.664
5	13.205	32.44	0.703
6	13.197	32.46	0.704
7	13.119	32.65	0.712
8	13.306	32.20	0.692
Average	13.352	32.09	0.688
Final score (lateral "G")			**0.688**

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	13.645	31.40	0.659
2	13.225	32.39	0.701
3	13.232	32.38	0.700
4	13.239	32.36	0.700
5	13.277	32.27	0.696
6	13.341	32.11	0.689
7	13.253	32.32	0.698
8	13.131	32.62	0.711
Average	13.293	32.23	0.694
Final score (lateral "G")			**0.694**

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	13.684	31.31	0.655
2	13.603	31.49	0.663
3	14.311	29.93	0.599
4	14.039	30.51	0.622
5	14.024	30.55	0.623
6	13.948	30.71	0.630
7	14.014	30.57	0.624
8	13.817	31.00	0.642
Average	13.930	30.76	0.632
Final score (lateral "G")			**0.632**

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	13.760	31.13	0.648
2	13.686	31.30	0.655
3	13.606	31.49	0.662
4	13.869	30.89	0.637
5	13.697	31.28	0.654
6	13.727	31.21	0.651
7	13.693	31.29	0.654
8	13.418	31.93	0.681
Average	13.682	31.31	0.655
Final score (lateral "G")			**0.655**

Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	14.153	30.27	0.612
2	14.131	30.32	0.614
3	13.984	30.63	0.627
4	13.784	31.08	0.645
5	13.767	31.12	0.647
6	13.853	30.92	0.639
7	14.230	30.10	0.605
8	13.953	30.70	0.630
Average	13.982	30.64	0.627
Final score (lateral "G")			**0.627**

Summary Test Data

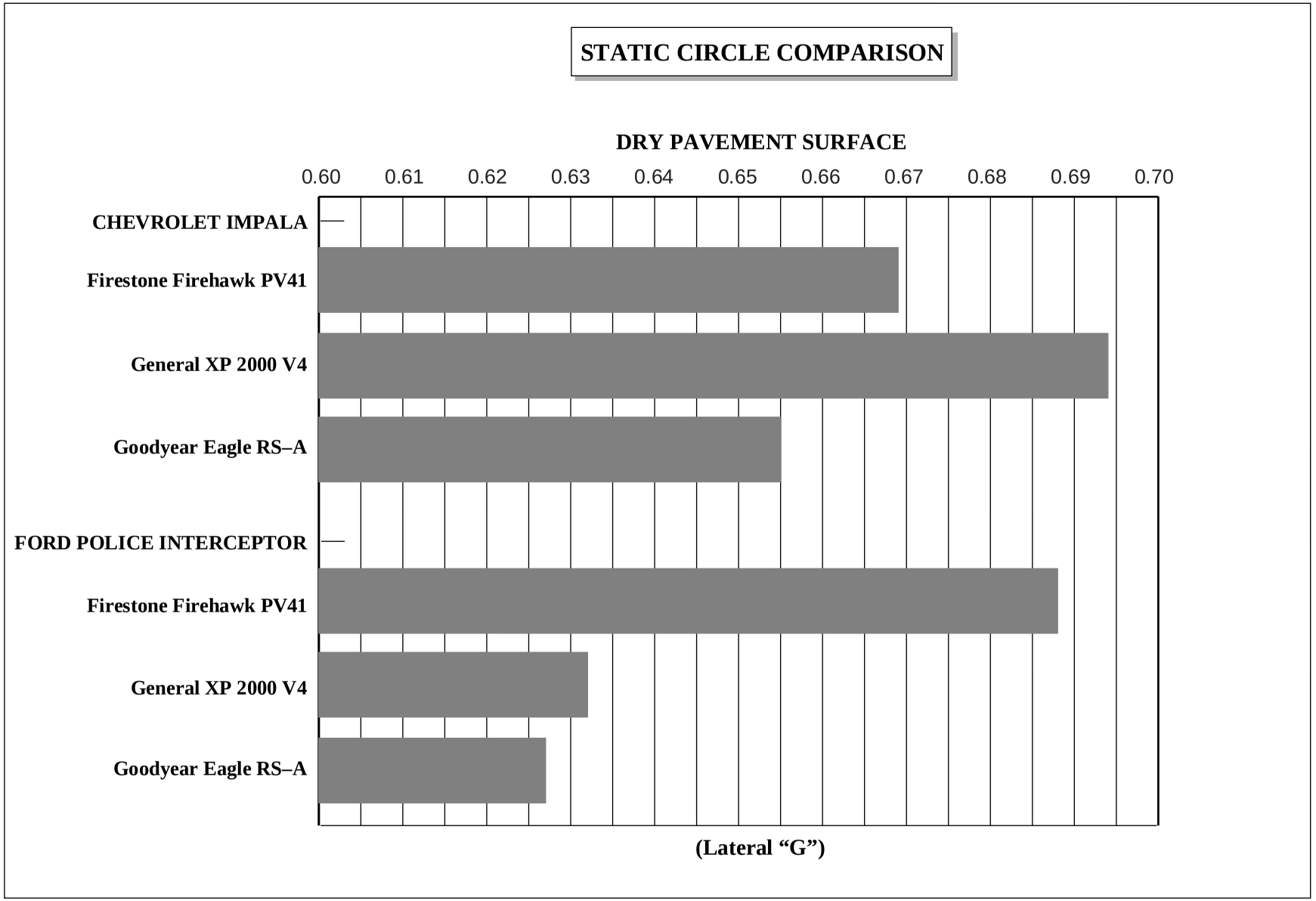
Static Circle Test
Dry Pavement Surface (628.3 feet in circumference)
Overall Scores

	Elapsed time (seconds)	Average speed (mph)	Lateral "G"	Percent difference*
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**				
Firestone Firehawk PV41**	13.537	31.65	0.669	1.84%
General XP 2000 V4**	13.293	32.23	0.694	0.00%
Goodyear Eagle RS–A**	13.682	31.31	0.655	2.93%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**				
Firestone Firehawk PV41***	13.352	32.09	0.688	0.00%
General XP 2000 V4***	13.930	30.76	0.632	4.33%
Goodyear Eagle RS–A***	13.982	30.64	0.627	4.72%

* The percent difference is obtained by subtracting the elapsed time of the tire of interest from the elapsed time of the best scoring tire (lowest score is best) and dividing that number by the elapsed time of the best scoring tire.

** Analysis showed no statistically significant difference between the Firestone and the Goodyear on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the General in this test (see Appendix).

*** Analysis showed no statistically significant difference between the General and the Goodyear on the Ford Police Interceptor; however, there is a statistically significant difference between both of them and the Firestone in this test (see Appendix).


STATIC CIRCLE COMPARISON
DRY PAVEMENT SURFACE
0.60
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.70
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Lateral "G")

Static Circle Test
Wet Pavement Surface

Test Objective

Determine the road-holding performance characteristics of each test tire in a steady-state turning situation on a wet pavement surface having a constant 3/8 inch to 1/2 inch of water depth. The course used has a flat polished concrete surface on which a circle has been created using pylons. The circle measures 200 feet in diameter and 628.3 feet in circumference. The driver is allowed 2 laps to accelerate and stabilize the vehicle at the highest speed possible while remaining within the marked lane. (See illustration below.) Once the vehicle is stabilized, the following 8 laps are timed, and the average of the timed laps is used to determine the final score for this portion of the evaluation, which is expressed in lateral "G" attained. Deficiencies in tire adhesion, or the tendency of the tire to slip sideways under hard, steady-state cornering maneuvers, will result in slower speeds, longer lap times, and a relatively lower overall score on this portion of the evaluation.

Test Methodology

Following a 2-lap tire warmup, each test vehicle equipped with the make and model of tire to be evaluated makes a minimum of 8 timed laps around the static circle course. The final score for each tire on this portion of the evaluation is the average of the 8 timed laps and is expressed in lateral "G" attained.

Formulas

To determine the lateral "G" attained, multiply pi times the diameter of the test circle and divide by the lap time. Square this quotient, and divide by the radius of the circle and then divide by 1 G.

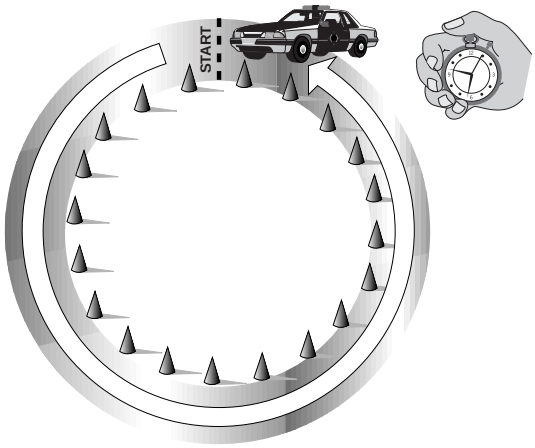
Example:

(3.14159 x 200 ft. ÷ lap time) x (3.14159 x 200 ÷ lap time) ÷ 100 ft. ÷ 32.2 ft./sec.
(pi) (diameter) (radius) (1 G)

To determine speed, divide the circumference of the test circle by the lap time, then divide by 1.4667 ft./sec.

Example:

628.3 ft. ÷ lap time ÷ 1.4667 ft./sec.



Test Data

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	20.562	20.83	0.290
2	21.086	20.32	0.276
3	21.150	20.25	0.274
4	20.892	20.50	0.281
5	21.109	20.29	0.275
6	21.052	20.35	0.277
7	20.982	20.42	0.278
8	20.807	20.59	0.283
Average	20.955	20.44	0.279
Final score (lateral "G")			**0.279**

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	21.279	20.13	0.271
2	21.205	20.20	0.273
3	21.459	19.96	0.266
4	21.733	19.71	0.260
5	21.869	19.59	0.256
6	21.511	19.91	0.265
7	21.823	19.63	0.257
8	22.180	19.31	0.249
Average	21.632	19.81	0.262
Final score (lateral "G")			**0.262**

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	21.261	20.15	0.271
2	21.481	19.94	0.266
3	21.555	19.87	0.264
4	21.318	20.10	0.270
5	20.699	20.70	0.286
6	20.879	20.52	0.281
7	21.120	20.28	0.275
8	22.043	19.43	0.252
Average	21.295	20.12	0.271
Final score (lateral "G")			**0.271**

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	21.815	19.64	0258
2	21.308	20.10	0.270
3	21.588	19.84	0.263
4	21.520	19.91	0.265
5	21.082	20.32	0.276
6	22.289	19.22	0.247
7	21.647	19.79	0.262
8	21.618	19.82	0.262
Average	21.608	19.83	0.263
Final score (lateral "G")			**0.263**

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	20.055	21.36	0.305
2	20.155	21.25	0.302
3	20.098	21.32	0.304
4	20.934	20.46	0.280
5	21.687	19.75	0.261
6	21.235	20.17	0.272
7	20.476	20.92	0.292
8	21.609	19.82	0.263
Average	20.781	20.63	0.285
Final score (lateral "G")			**0.285**

Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Elapsed time (seconds)	Speed (mph)	Lateral "G"
1	22.708	18.87	0.238
2	21.374	20.04	0.268
3	22.300	19.21	0.247
4	22.313	19.20	0.246
5	21.346	20.07	0.269
6	22.109	19.38	0.251
7	22.584	18.97	0.240
8	22.621	18.94	0.240
Average	22.169	19.33	0.250
Final score (lateral "G")			**0.250**

Summary Test Data

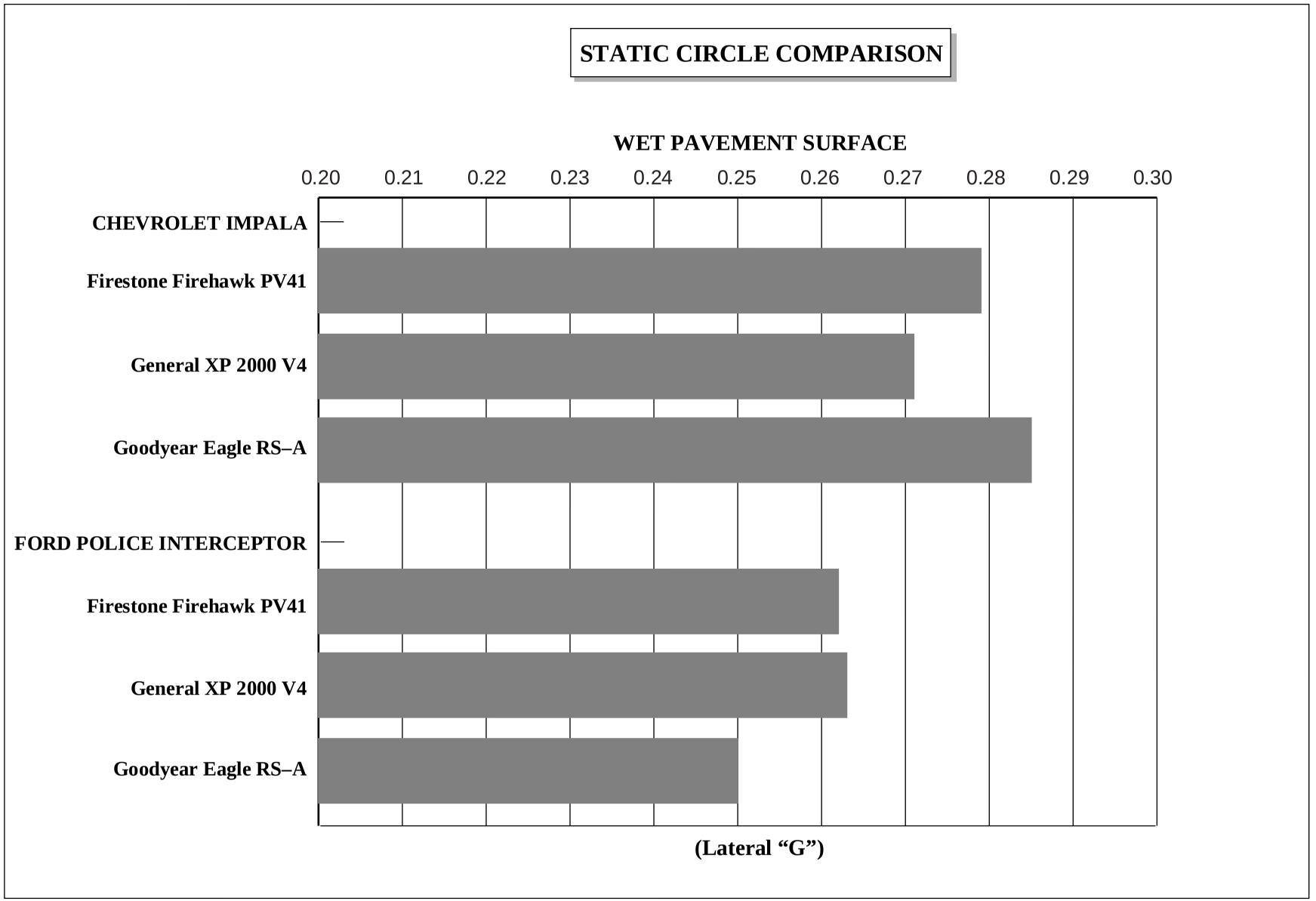
Static Circle Test
Wet Pavement Surface (628.3 feet in circumference)
Overall Scores

	Elapsed time (seconds)	Average speed (mph)	Lateral "G"	Percent difference*
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**				
Firestone Firehawk PV41**	20.955	20.44	0.279	0.84%
General XP 2000 V4**	21.295	20.12	0.271	2.47%
Goodyear Eagle RS–A**	20.781	20.63	0.285	0.00%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**				
Firestone Firehawk PV41***	21.632	19.81	0.262	0.11%
General XP 2000 V4***	21.608	19.83	0.263	0.00%
Goodyear Eagle RS–A***	22.169	19.33	0.250	2.60%

* The percent difference is obtained by subtracting the elapsed time of the tire of interest from the elapsed time of the best scoring tire (lowest score is best) and dividing that number by the elapsed time of the best scoring tire.

** Analysis showed no statistically significant difference between the three brands of tires tested on the Chevrolet Impala in this test (see Appendix).

*** Analysis showed no statistically significant difference between the Firestone and the General on the Ford Police Interceptor; however, there is a statistically significant difference between both of them and the Goodyear in this test (see Appendix).


STATIC CIRCLE COMPARISON
WET PAVEMENT SURFACE
0.20
0.21
0.22
0.23
0.24
0.25
0.26
0.27
0.28
0.29
0.30
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Lateral “G”)

Serpentine Test
Dry Pavement Surface

Test Objective

Determine each tire's transient response characteristics and performance on a dry pavement surface. The course used is straight and flat with 550 feet of asphalt and 150 feet of concrete. Pylons are set in a straight line and spaced 100 feet apart. The approach speed is 60 mph, and the driver is required to weave through the pylons while maintaining a speed as close to the approach speed as possible. (See illustration below.) Serious deficiencies in transient response will result in longer elapsed times, slower speeds, and a lower overall score on this portion of the evaluation.

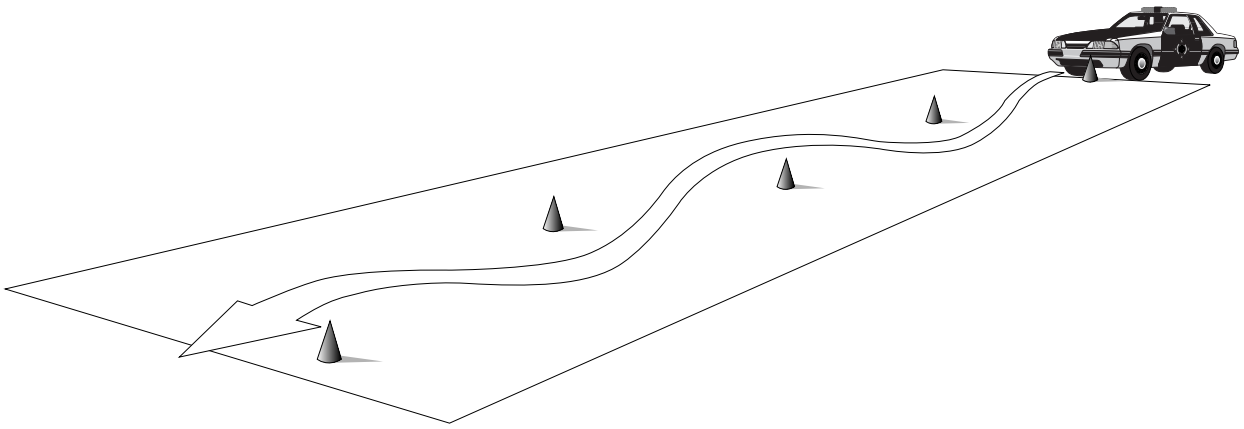
Test Methodology

Following a 2-mile tire warmup, each test vehicle equipped with the make and model of tire to be evaluated is driven through the serpentine course a minimum of 15 times. The average is for all 15 runs, while the final score for each tire is the average of the fastest 12 runs.

Formula

To determine the vehicle's speed, divide the length of the course (700 ft.) by 1.4667 ft./sec., then divide by the elapsed time.

Example:
700 ft. ÷ 1.4667 ft./sec. ÷ elapsed time
(length of course)



Test Data

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	8.837	54.01
	2	8.818	54.12
	3	8.662	55.10
	4	8.769	54.43
	5	8.594	55.53
	6	8.790	54.30
	7	9.094	52.48
	8	9.027	52.87
	9	8.893	53.67
	10	8.949	53.33
	11	8.756	54.51
	12	8.681	54.98
	13	8.688	54.93
	14	8.742	54.59
	15	8.910	53.56
	Average*	8.814	54.16
Final score**		**8.762**	**54.48**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	8.956	53.29
	2	9.005	53.00
	3	8.810	54.17
	4	9.129	52.28
	5	9.176	52.01
	6	9.069	52.63
	7	9.163	52.09
	8	9.597	49.73
	9	8.937	53.40
	10	9.145	52.19
	11	8.960	53.27
	12	8.685	54.95
	13	8.818	54.12
	14	8.913	53.55
	15	8.832	54.04
	Average*	9.013	52.98
Final score**		**8.938**	**53.41**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.023	52.89
	2	9.064	52.65
	3	9.028	52.86
	4	8.911	53.56
	5	8.818	54.12
	6	8.976	53.17
	7	8.743	54.59
	8	9.088	52.52
	9	8.916	53.53
	10	9.134	52.25
	11	8.819	54.12
	12	8.991	53.08
	13	9.113	52.37
	14	9.138	52.23
	15	8.908	53.58
	Average*	8.978	53.17
Final score**		**8.940**	**53.39**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.162	52.09
	2	9.249	51.60
	3	8.946	53.35
	4	9.237	51.67
	5	9.136	52.24
	6	9.018	52.92
	7	9.096	52.47
	8	9.060	52.68
	9	9.082	52.55
	10	8.911	53.56
	11	9.027	52.87
	12	9.324	51.19
	13	8.909	53.57
	14	8.900	53.62
	15	8.894	53.66
	Average*	9.063	52.67
Final score**		**9.012**	**52.97**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	8.728	54.68
	2	8.561	55.75
	3	8.699	54.86
	4	8.595	55.53
	5	8.728	54.68
	6	8.956	53.29
	7	9.028	52.86
	8	8.971	53.20
	9	9.094	52.48
	10	8.995	53.06
	11	8.881	53.74
	12	8.988	53.10
	13	8.761	54.48
	14	8.767	54.44
	15	8.992	53.08
	Average*	8.850	53.95
Final score**		**8.802**	**54.24**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Dry Pavement Surface (700 feet)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.238	51.66
	2	9.271	51.48
	3	9.114	52.37
	4	9.184	51.97
	5	9.276	51.45
	6	9.195	51.90
	7	9.397	50.79
	8	9.132	52.26
	9	9.088	52.52
	10	9.004	53.01
	11	8.845	53.96
	12	9.090	52.50
	13	9.002	53.02
	14	8.943	53.37
	15	9.024	52.89
	Average*	9.120	52.34
Final score**		**9.072**	**52.62**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Summary Test Data

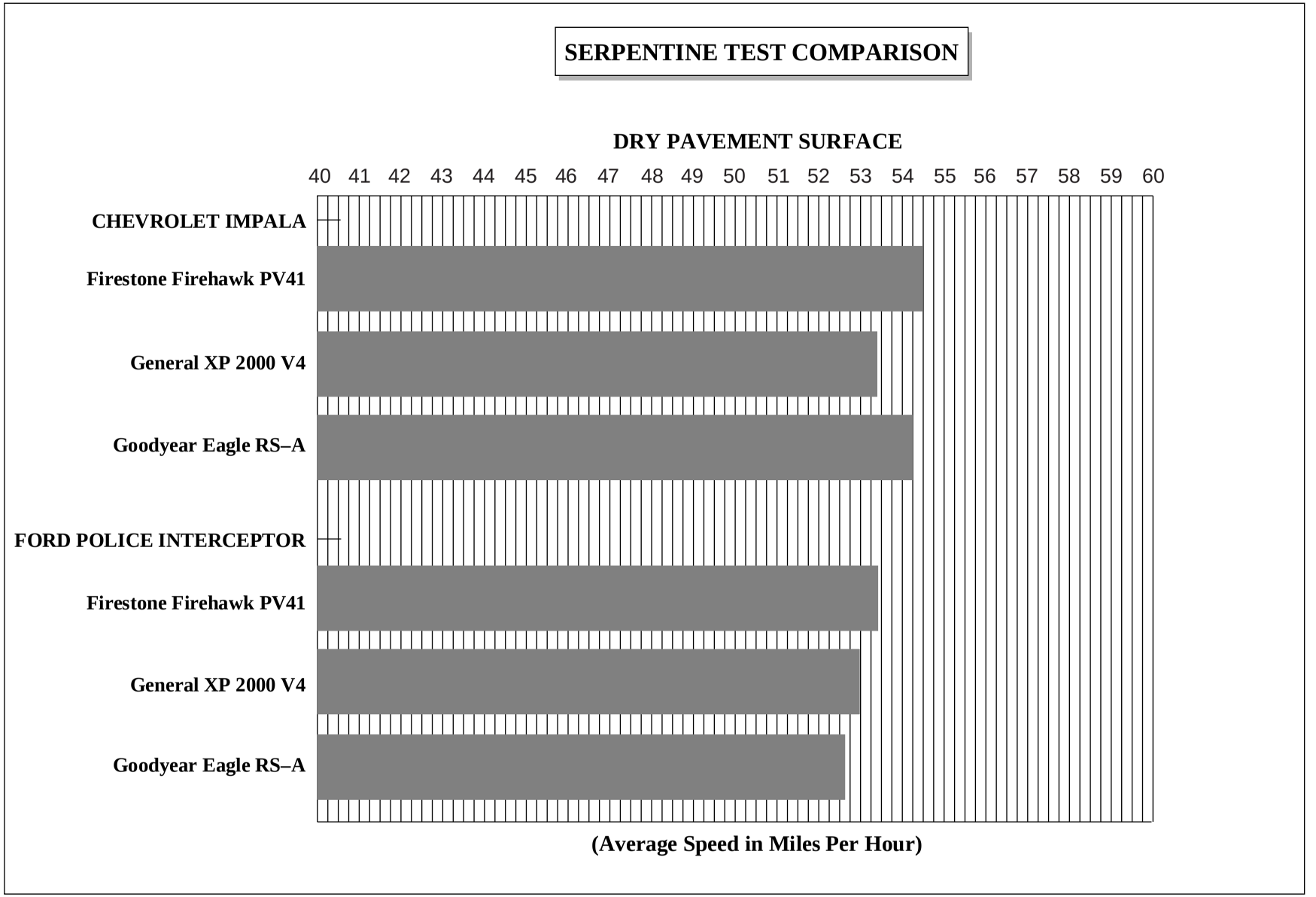
Serpentine Test
Dry Pavement Surface (700 feet)
Overall Scores

	Elapsed time (seconds)	Average speed (mph)	Percent difference*
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41**	8.762	54.48	0.00%
General XP 2000 V4**	8.940	53.39	2.03%
Goodyear Eagle RS–A**	8.802	54.24	0.46%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	8.938	53.41	0.00%
General XP 2000 V4***	9.012	52.97	0.83%
Goodyear Eagle RS–A***	9.072	52.62	1.50%

* The percent difference is obtained by subtracting the elapsed time of the tire of interest from the elapsed time of the best scoring tire (lowest score is best) and dividing that number by the elapsed time of the best scoring tire.

** Analysis showed no statistically significant difference between the Firestone and the Goodyear on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the General in this test (see Appendix).

*** Analysis showed no statistically significant difference between the Firestone and the General on the Ford Police Interceptor; however, there is a statistically significant difference between both of them and the Goodyear in this test (see Appendix).


SERPENTINE TEST COMPARISON
DRY PAVEMENT SURFACE
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Average Speed in Miles Per Hour)

Serpentine Test
Wet Pavement Surface

Test Objective

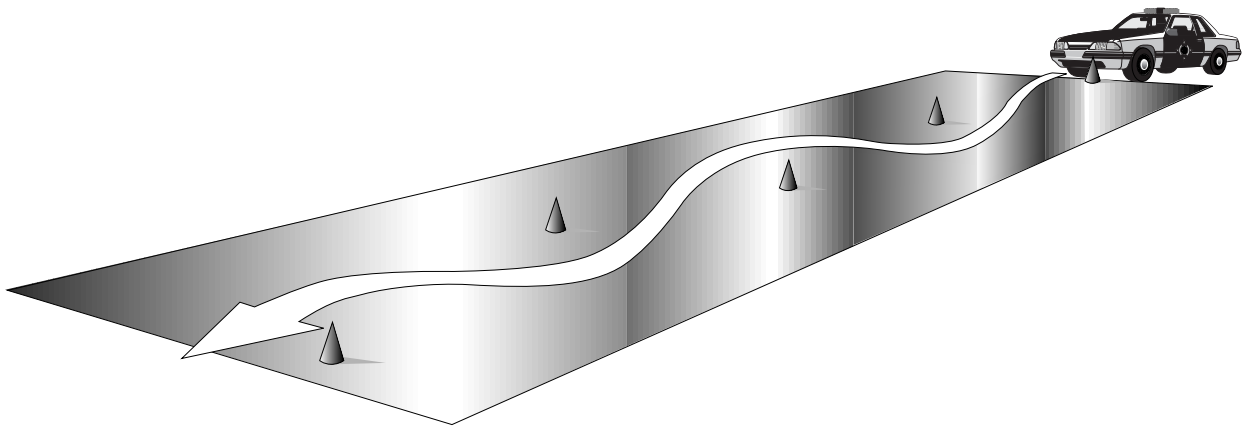
Determine each tire's transient response characteristics and performance on a wet pavement surface. The course used is straight and flat with approximately 420 feet of asphalt surface. Pylons are set in a straight line and spaced 60 feet apart. The approach speed is 35 mph, and the driver is required to weave through the pylons while maintaining speed as close to the approach speed as possible. (See illustration below.) Serious deficiencies in transient response during wet pavement maneuvering will result in longer elapsed times, slower speeds, and a lower overall score on this portion of the evaluation.

Test Methodology

Following a 2-mile tire warmup, each test vehicle equipped with the make and model of tire to be evaluated is driven through the serpentine course a minimum of 15 times. The average is for all 15 runs, while the final score for each tire is the average of the fastest 12 runs.

Formula

To determine the vehicle's speed, divide the length of the course (420 ft.) by 1.4667 ft./sec., then divide by the elapsed time.
Example:
420 ft. ÷ 1.4667 ft./sec. ÷ elapsed time
(length of course)



Test Data

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	8.702	32.91
	2	8.888	32.22
	3	9.098	31.47
	4	8.878	32.25
	5	9.163	31.25
	6	8.811	32.50
	7	8.953	31.98
	8	8.745	32.75
	9	8.709	32.88
	10	8.947	32.01
	11	8.992	31.85
	12	9.070	31.57
	13	8.890	32.21
	14	9.119	31.40
	15	8.964	31.95
	Average*	8.929	32.08
Final score**		**8.879**	**32.26**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.285	30.84
	2	9.600	29.83
	3	9.374	30.55
	4	8.971	31.92
	5	9.522	30.07
	6	9.184	31.18
	7	9.075	31.55
	8	8.900	32.17
	9	8.902	32.17
	10	8.954	31.98
	11	9.077	31.55
	12	9.064	31.59
	13	9.027	31.72
	14	9.028	31.72
	15	9.111	31.43
	Average*	9.138	31.35
Final score**		**9.048**	**31.65**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.027	31.72
	2	9.091	31.50
	3	9.061	31.60
	4	9.153	31.29
	5	9.302	30.78
	6	9.277	30.87
	7	9.142	31.32
	8	9.181	31.19
	9	9.127	31.37
	10	9.072	31.56
	11	8.907	32.15
	12	8.839	32.40
	13	9.018	31.75
	14	9.141	31.33
	15	9.124	31.39
	Average*	9.097	31.48
Final score**		**9.059**	**31.62**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.600	29.83
	2	9.295	30.81
	3	9.523	30.07
	4	8.995	31.84
	5	9.205	31.11
	6	9.209	31.10
	7	9.242	30.98
	8	9.264	30.91
	9	9.293	30.81
	10	9.523	30.07
	11	9.130	31.36
	12	9.148	31.30
	13	9.420	30.40
	14	9.289	30.83
	15	9.183	31.18
	Average*	9.288	30.84
Final score**		**9.223**	**31.05**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	8.856	32.33
	2	8.822	32.46
	3	8.989	31.86
	4	9.125	31.38
	5	9.078	31.54
	6	8.761	32.69
	7	8.887	32.22
	8	8.810	32.50
	9	8.973	31.91
	10	9.087	31.51
	11	9.007	31.79
	12	9.115	31.42
	13	8.956	31.97
	14	9.114	31.42
	15	8.741	32.76
	Average*	8.955	31.99
Final score**		**8.914**	**32.13**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Serpentine Test
Wet Pavement Surface (420 feet)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

Driver	Run number	Elapsed time (seconds)	Speed (mph)
Kourelis	1	9.178	31.20
	2	9.200	31.13
	3	9.516	30.09
	4	9.379	30.53
	5	9.159	31.27
	6	9.077	31.55
	7	9.232	31.02
	8	8.984	31.87
	9	9.126	31.38
	10	9.260	30.92
	11	8.958	31.97
	12	9.117	31.41
	13	9.121	31.40
	14	9.341	30.66
	15	9.347	30.64
	Average*	9.200	31.13
Final score**		**9.146**	**31.31**

* Calculated from all 15 runs.

** Calculated from the fastest 12 runs.

Summary Test Data

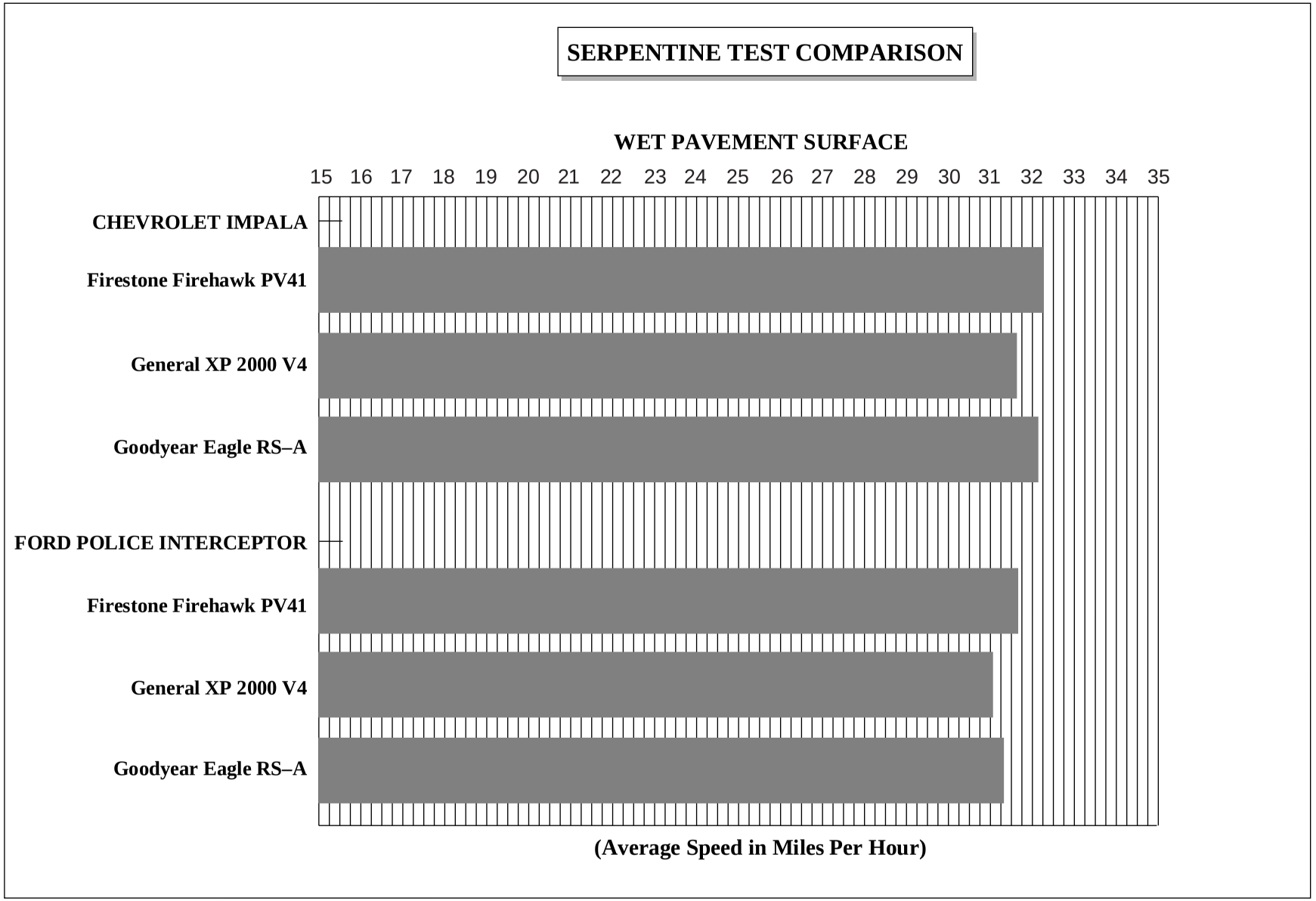
Serpentine Test
Wet Pavement Surface (420 feet)
Overall Scores

	Elapsed time (seconds)	Average speed (mph)	Percent difference*
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41**	8.879	32.26	0.00%
General XP 2000 V4**	9.059	31.62	2.03%
Goodyear Eagle RS–A**	8.914	32.13	0.39%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	9.048	31.65	0.00%
General XP 2000 V4***	9.223	31.05	1.93%
Goodyear Eagle RS–A***	9.146	31.31	1.08%

* The percent difference is obtained by subtracting the elapsed time of the tire of interest from the elapsed time of the best scoring tire (lowest score is best) and dividing that number by the elapsed time of the best scoring tire.

** Analysis showed no statistically significant difference between the Firestone and the Goodyear on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the General in this test (see Appendix).

*** Analysis showed no statistically significant difference between the General and the Goodyear on the Ford Police Interceptor; however, there is a statistically significant difference between both of them and the Firestone in this test (see Appendix).


SERPENTINE TEST COMPARISON
WET PAVEMENT SURFACE
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Average Speed in Miles Per Hour)

Stopping Distance Test Dry Pavement Surface

Test Objective

Determine the performance characteristics of the test tires in a simulated "panic" stop of a patrol vehicle on a dry pavement surface. The course used has a straight, flat, granite asphalt surface. A center lane marks where the braking maneuvers are to be done. The approach speed is just over 60 mph. The test vehicle is in Anti-Lock Brake System (ABS) mode when the driver applies the brakes as close to 60 mph as possible. (See illustration below.) Both the exact speed at brake application and the distance from brake application to complete stop are electronically recorded. Average deceleration rate is then determined. Deficiencies in tire adhesion will result in longer stopping distances and a relatively lower score on this portion of the evaluation.

Test Methodology

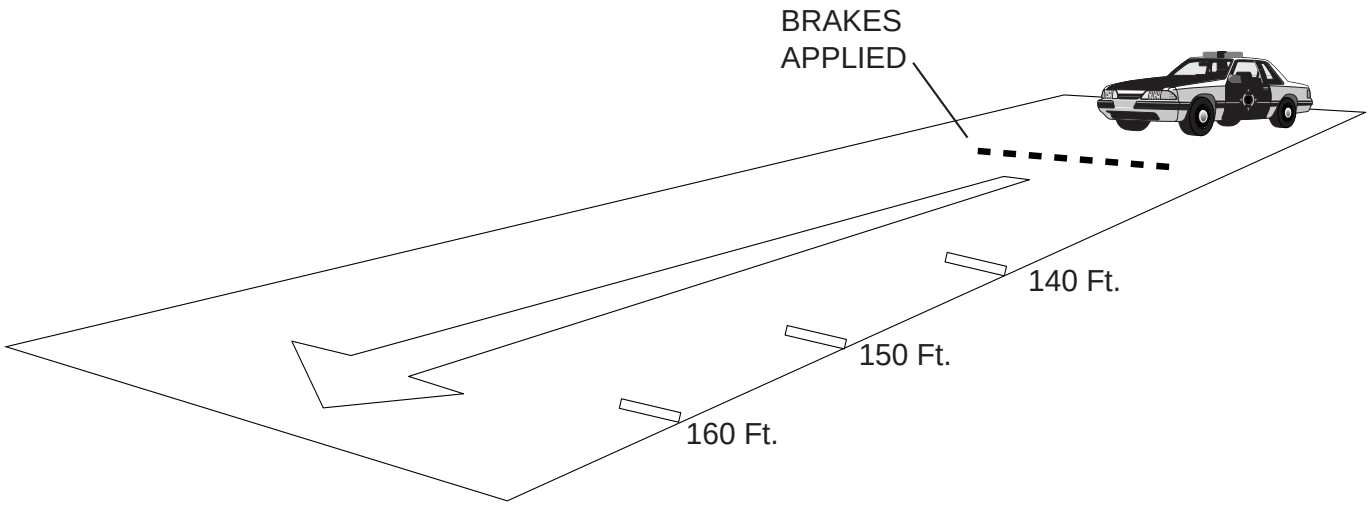
Following a 1-mile tire warmup, each test vehicle equipped with the make and model of tire to be evaluated makes a minimum of six measured panic stops with the ABS in operation. The final score for each tire on this portion of the evaluation is the average of the six measured stops.

Formula

To determine the deceleration rate, translate the initial speed into ft./sec. by multiplying the initial speed by 1.4667. Square this ft./sec. product and divide the resulting square by twice the listed stopping distance.

Example:

1. 60.50 mph x 1.4667 = 88.735 ft./sec.
2. 88.735 ft./sec. x 88.735 ft./sec. = 7,873.90 $ft.^2/sec.^2$
3. 7,873.90 $ft.^2/sec.^2$ ÷ (157.00 ft. x 2) = 25.08 $ft./sec.^2$



Test Data

Stopping Distance Test
Dry Pavement Surface

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	61.5	156.6	25.98
2	60.6	151.7	26.04
3	60.3	150.8	25.93
4	60.8	153.6	25.89
5	60.8	153.1	25.97
6	60.5	151.8	25.94
Average score	60.8	152.9	**25.96**
(Calculated stopping distance from 60 mph)			**149.2 feet**

Stopping Distance Test
Dry Pavement Surface

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	59.3	143.0	26.45
2	59.0	142.4	26.29
3	59.4	143.1	26.52
4	59.6	143.1	26.70
5	58.6	139.1	26.55
6	59.8	145.7	26.40
Average score	59.3	142.7	**26.49**
(Calculated stopping distance from 60 mph)			**146.2 feet**

Stopping Distance Test
Dry Pavement Surface

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	59.4	143.0	26.54
2	61.1	157.0	25.58
3	61.2	151.2	26.64
4	60.2	144.2	27.03
5	62.2	156.8	26.54
6	59.9	144.8	26.65
Average score	60.7	149.5	**26.50**
(Calculated stopping distance from 60 mph)			**146.1 feet**

Stopping Distance Test
Dry Pavement Surface

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.6	148.0	26.69
2	59.5	142.8	26.67
3	59.4	139.8	27.15
4	59.5	144.0	26.44
5	60.9	147.0	27.14
6	60.9	150.8	26.45
Average score	60.1	145.4	**26.76**
(Calculated stopping distance from 60 mph)			**144.7 feet**

Stopping Distance Test
Dry Pavement Surface

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	59.6	144.8	26.39
2	60.2	145.4	26.81
3	60.2	145.9	26.72
4	60.2	144.8	26.92
5	61.3	152.6	26.49
6	60.1	142.6	27.24
Average score	60.3	146.0	**26.76**
(Calculated stopping distance from 60 mph)			**144.7 feet**

Stopping Distance Test
Dry Pavement Surface

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.8	150.1	26.49
2	59.9	143.4	26.91
3	61.7	150.3	27.24
4	60.9	147.4	27.06
5	60.2	143.4	27.18
6	60.8	146.6	27.12
Average score	60.7	146.9	**27.00**
(Calculated stopping distance from 60 mph)			**143.4 feet**

Summary Test Data

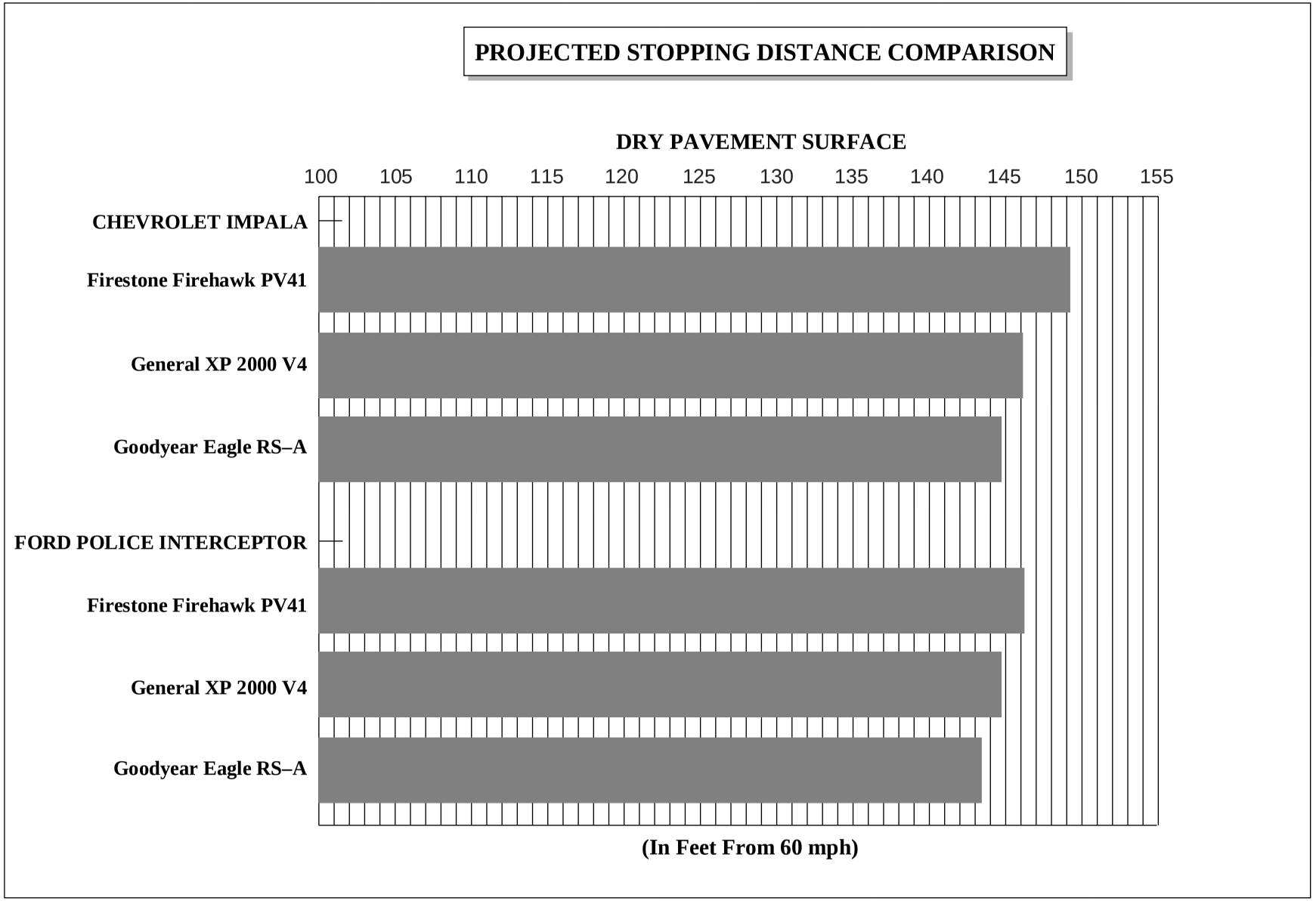
Stopping Distance Test
Dry Pavement Surface
Overall Scores

	Average deceleration rate (ft./sec.^{2})	Stopping distance* (ft.)	Percent difference**
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	25.96	149.2	2.99%
General XP 2000 V4***	26.50	146.1	0.97%
Goodyear Eagle RS–A***	26.76	144.7	0.00%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	26.49	146.2	1.89%
General XP 2000 V4***	26.76	144.7	0.89%
Goodyear Eagle RS–A***	27.00	143.4	0.00%

* Calculated stopping distance from 60 mph. Both vehicles are equipped with ABS.

** The percent difference is obtained by subtracting the average deceleration rate of the tire of interest from the average deceleration rate of the best scoring tire (highest score is best) and dividing that number by the average deceleration rate of the best scoring tire.

*** Analysis showed no statistically significant difference between the Goodyear and the General on either the Chevrolet Impala or the Ford Police Interceptor; there also is no statistically significant difference between the General and the Firestone on either car; there is, however, a statistically significant difference between the Goodyear and the Firestone on both cars in this test (see Appendix).


PROJECTED STOPPING DISTANCE COMPARISON
DRY PAVEMENT SURFACE
100
105
110
115
120
125
130
135
140
145
150
155
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(In Feet From 60 mph)

Stopping Distance Test Wet Pavement Surface

Test Objective

Determine the performance characteristics of the test tires in a simulated "panic" stop of a patrol vehicle on a wet pavement surface. The course used has a straight, flat, granite asphalt surface. Pylons are set up to mark where the braking maneuvers are done. The approach speed is just over 60 mph. The vehicle is in ABS mode when the driver applies the brakes as close to 60 mph as possible. (See illustration below.)

Both the exact speed at brake application and the distance from brake application to complete stop are electronically recorded. Average deceleration rate is then determined. Deficiencies in tire adhesion will result in longer stopping distances and a relatively lower score on this portion of the evaluation.

Test Methodology

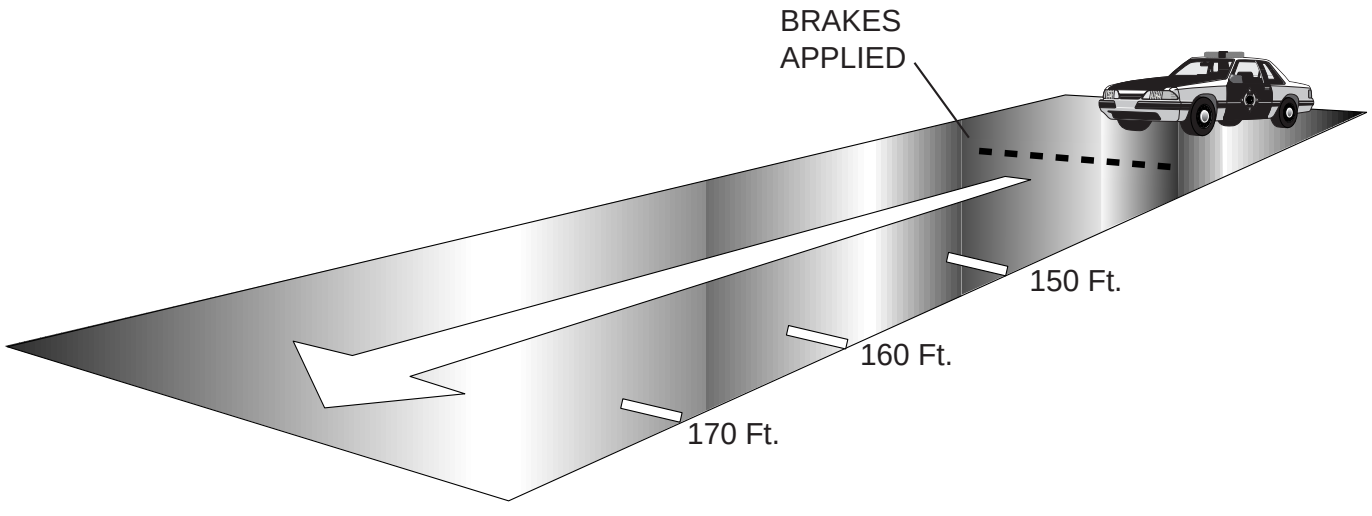
Following a 1-mile tire warm-up, each test vehicle equipped with the make and model of tire to be evaluated makes a minimum of six measured panic stops, with the ABS in operation. The final score for each tire on this portion of the evaluation is the average of the six measured stops.

Formula

To determine the deceleration rate, translate the initial speed into ft./sec. by multiplying the initial speed by 1.4667. Square this ft./sec. product and divide the resulting square by twice the listed stopping distance.

Example:

1. 60.50 mph x 1.4667 = 88.735 ft./sec.
2. 88.735 ft./sec. x 88.735 ft./sec. = 7,873.90 $ft.^2/sec.^2$
3. 7,873.90 $ft.^2/sec.^2$ ÷ (157.0 ft. x 2) = 25.08 $ft./sec.^2$



Test Data

Stopping Distance Test
Wet Pavement Surface

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.6	162.3	24.34
2	60.8	162.8	24.42
3	61.2	166.4	24.21
4	61.2	163.7	24.61
5	60.7	161.8	24.49
6	61.6	166.2	24.56
Average score	61.0	163.9	**24.44**
(Calculated stopping distance from 60 mph)			**158.4 feet**

Stopping Distance Test
Wet Pavement Surface

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.3	159.8	24.47
2	59.5	153.8	24.76
3	61.0	164.7	24.30
4	61.1	162.1	24.77
5	59.7	156.5	24.50
6	60.5	157.9	24.93
Average score	60.4	159.1	**24.62**
(Calculated stopping distance from 60 mph)			**157.3 feet**

Stopping Distance Test
Wet Pavement Surface

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.4	164.7	23.82
2	62.0	165.0	25.06
3	59.8	158.1	24.33
4	59.8	161.6	23.80
5	60.5	166.3	23.67
6	61.1	162.1	24.77
Average score	60.6	163.0	**24.24**
(Calculated stopping distance from 60 mph)			**159.7 feet**

Stopping Distance Test
Wet Pavement Surface

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	61.5	166.0	24.51
2	59.0	151.8	24.67
3	60.8	162.9	24.41
4	60.5	162.6	24.21
5	60.9	162.2	24.59
6	60.9	162.9	24.49
Average score	60.6	161.4	**24.48**
(Calculated stopping distance from 60 mph)			**158.2 feet**

Stopping Distance Test
Wet Pavement Surface

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	59.7	166.9	22.97
2	61.0	168.8	23.71
3	60.8	166.3	23.91
4	61.4	172.4	23.52
5	59.5	163.8	23.25
6	59.5	161.0	23.65
Average score	60.3	166.5	**23.50**
(Calculated stopping distance from 60 mph)			**164.8 feet**

Stopping Distance Test
Wet Pavement Surface

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**
DRIVER: **Sanders**

Run number	Initial speed (mph)	Stopping distance (ft.)	Deceleration rate (ft./sec.^{2})
1	60.9	154.8	25.77
2	60.3	156.0	25.07
3	61.5	162.0	25.11
4	60.7	156.3	25.36
5	59.1	152.1	24.70
6	60.0	155.1	24.97
Average score	60.4	156.1	**25.16**
(Calculated stopping distance from 60 mph)			**153.9 feet**

Summary Test Data

Stopping Distance Test
Wet Pavement Surface
Overall Scores

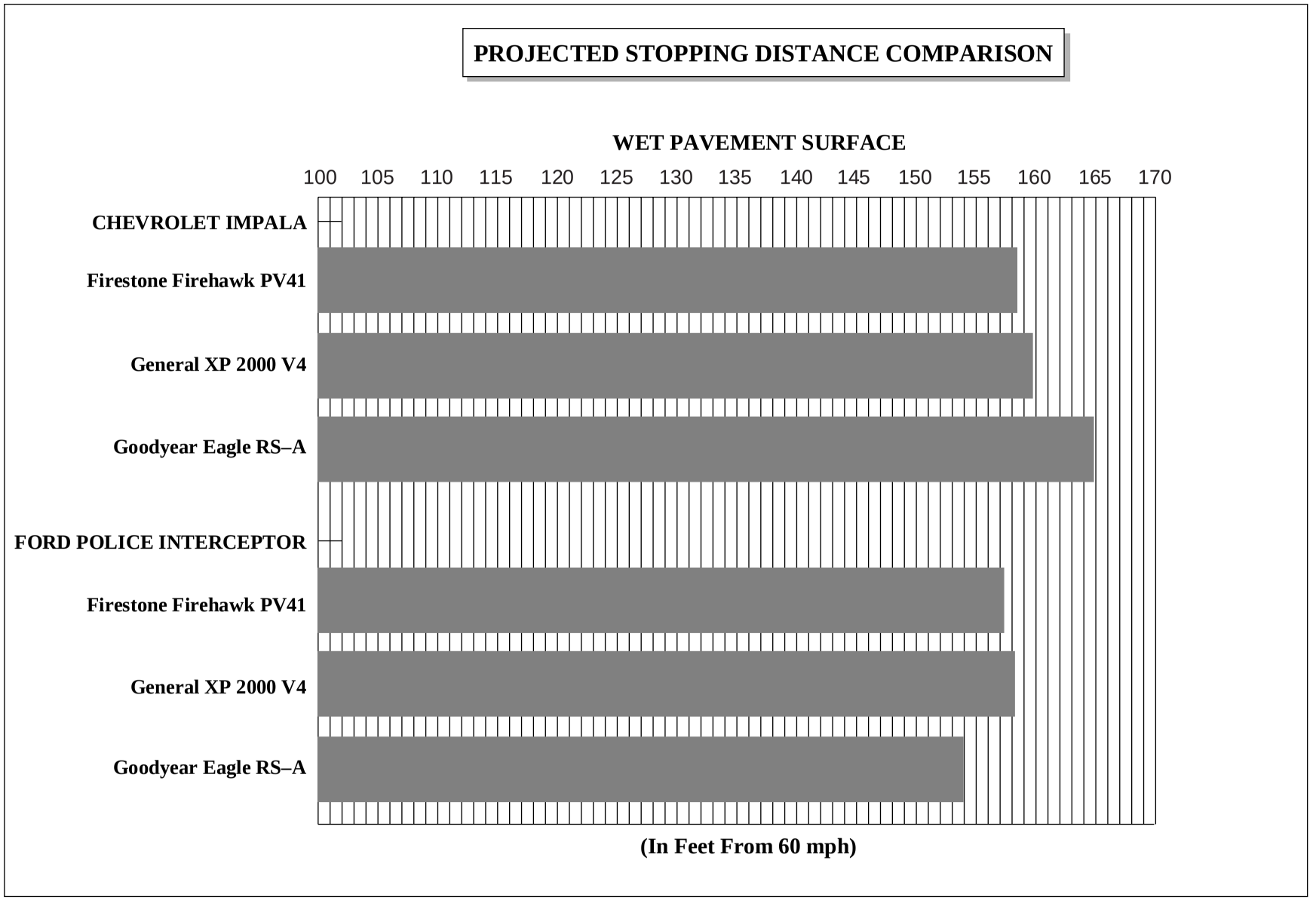
	Average deceleration rate (ft./sec.^{2})	Stopping distance* (ft.)	Percent difference**
CAR: **Chevrolet Impala**			
TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	24.44	158.4	0.00%
General XP 2000 V4***	24.24	159.7	0.82%
Goodyear Eagle RS–A***	23.50	164.8	3.85%
CAR: **Ford Police Interceptor**			
TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41****	24.62	157.3	2.15%
General XP 2000 V4****	24.48	158.2	2.70%
Goodyear Eagle RS–A****	25.16	153.9	0.00%

* Calculated stopping distance from 60 mph. Both vehicles are equipped with ABS.

** The percent difference is obtained by subtracting the average deceleration rate of the tire of interest from the average deceleration rate of the best scoring tire (highest score is best) and dividing that number by the average deceleration rate of the best scoring tire.

*** Analysis showed no statistically significant difference between the Firestone and the General on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the Goodyear in this test (see Appendix).

**** Analysis showed no statistically significant difference between the Firestone and the General on the Ford Police Interceptor; however, there is a statistically significant difference between both of them and the Goodyear in this test (see Appendix).


PROJECTED STOPPING DISTANCE COMPARISON
WET PAVEMENT SURFACE
100 105 110 115 120 125 130 135 140 145 150 155 160 165 170
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(In Feet From 60 mph)

High-Speed Handling Test

Test Objective

Determine each tire's high-speed pursuit handling characteristics and performance on a 1.43-mile (7,553 feet) road-racing type course. The course contains high-speed curves, low-speed corners, and straightaways and, with the exception of other traffic, simulates actual pursuit conditions in the field. This evaluation is a test of the tire manufacturers' success in blending the transient response, cornering, and rapid deceleration characteristics of a tire. Serious deficiencies in any of these critical areas will result in longer lap times and a lower overall score on this portion of the evaluation.

Test Methodology

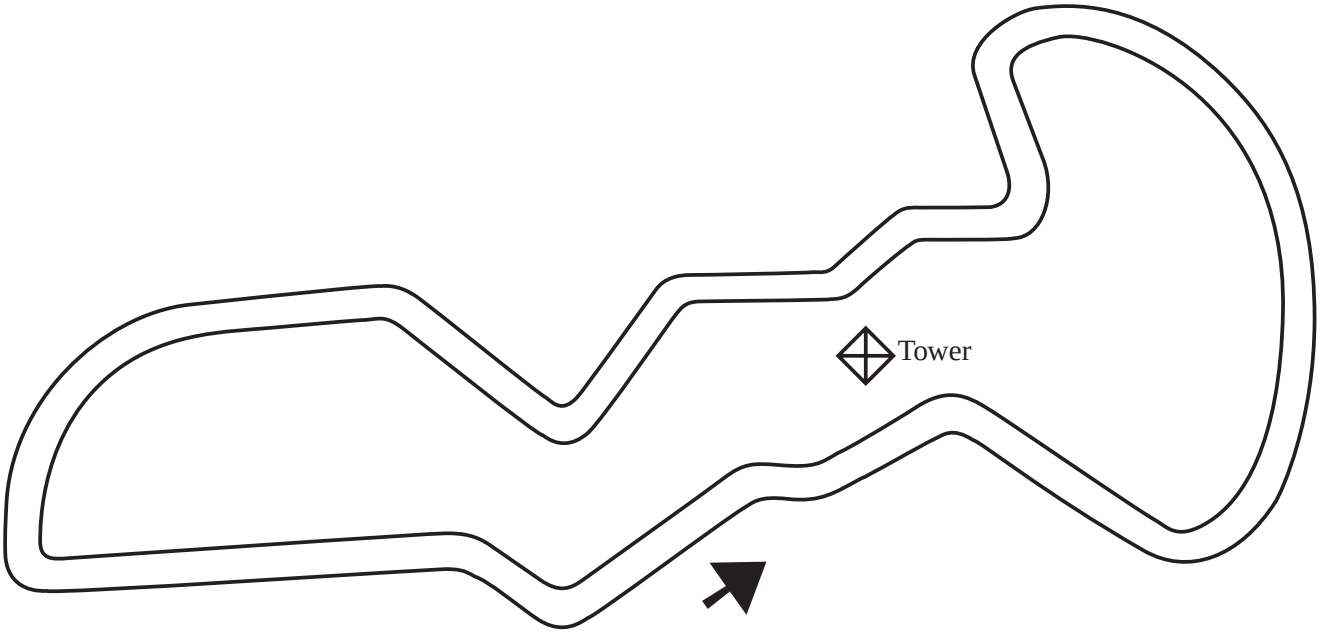
Following 2 warmup laps, each test vehicle equipped with the make and model of tire to be evaluated is driven over the course by 3 drivers, for at least 15 timed laps. The final score for each tire will be the average of the fastest 4 laps by each of the drivers, for a total of 12 laps.

Formula

To determine the average speed, divide the number of feet in the road course by the overall average, then divide by 1.4667 ft./sec.

Example:
7,553 ft. ÷ overall average ÷ 1.4667 ft./sec.

Test Facility Diagram
Federal Law Enforcement Training Center
Highway Response Course—Range #7
Glynco, Georgia



1.43 Miles

Test Data

High-Speed Handling Test

CAR: **Chevrolet Impala**

Tire	Kourelis (seconds)	Sanders (seconds)	VanDenBerg (seconds)	Overall average* (seconds)	Average speed (mph)
Firestone	87.212	86.929	87.043		
Firehawk PV41	86.787	87.094	86.638		
P225/60R–16	87.058	86.851	86.920		
	87.018	87.600	86.547		
	88.117	87.004	87.177		
Average:	**87.238**	**87.096**	**86.865**	**86.925**	**59.24**
General	87.108	86.858	86.258		
XP 2000 V4	87.825	86.956	86.821		
P225/60R–16	87.087	87.081	86.148		
	86.956	87.170	87.695		
	88.775	87.734	87.006		
Average:	**87.550**	**87.160**	**86.787**	**86.940**	**59.23**
Goodyear	86.485	85.889	86.703		
Eagle RS–A	86.526	86.248	86.633		
P225/60R–16	86.888	86.025	86.228		
	86.719	85.367	86.339		
	86.733	86.422	86.366		
Average:	**86.670**	**85.990**	**86.454**	**86.297**	**59.67**

* Overall averages calculated from the best 4 laps for each driver (12 laps total).

High-Speed Handling Test

CAR: **Ford Police Interceptor**

Tire	Kourelis (seconds)	Sanders (seconds)	VanDenBerg (seconds)	Overall average* (seconds)	Average speed (mph)
Firestone	85.753	85.230	84.922		
Firehawk PV41	85.709	85.500	84.683		
P225/60R–16	85.285	85.165	84.461		
	86.358	85.012	84.964		
	86.031	85.186	85.243		
Average:	**85.827**	**85.219**	**84.855**	**85.200**	**60.44**
General	87.193	85.435	85.545		
XP 2000 V4	86.623	84.603	85.590		
P225/60R–16	86.138	85.021	85.660		
	86.542	85.167	84.815		
	86.365	85.041	85.674		
Average:	**86.572**	**85.053**	**85.457**	**85.593**	**60.16**
Goodyear	86.554	86.108	85.103		
Eagle RS–A	86.365	85.307	84.753		
P225/60R–16	86.006	85.436	84.480		
	86.216	85.369	85.098		
	85.305	84.731	85.175		
Average:	**86.089**	**85.390**	**84.922**	**85.347**	**60.34**

* Overall averages calculated from the best 4 laps for each driver (12 laps total).

Summary Test Data

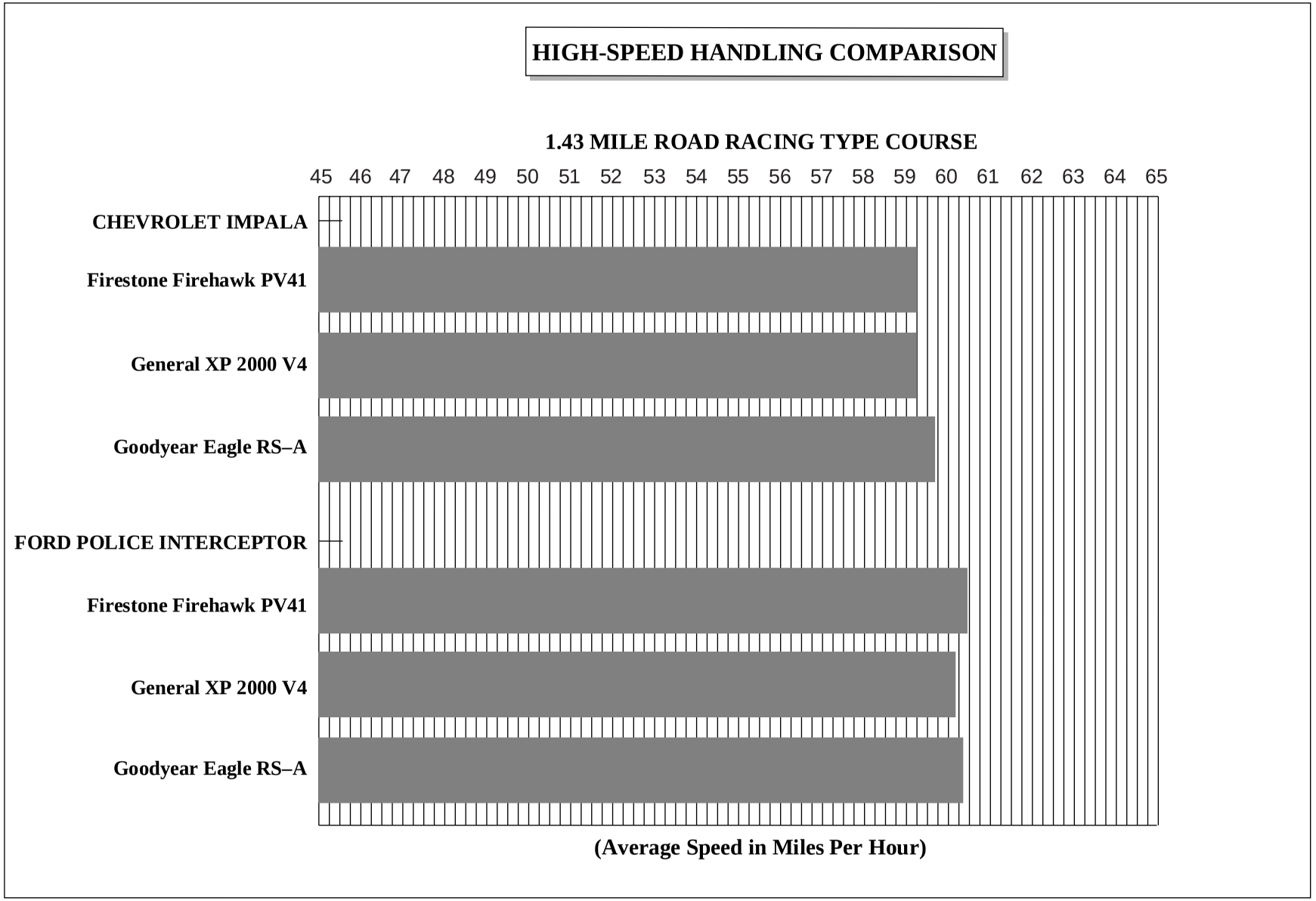
High-Speed Handling Test
Overall Scores

	Average lap time (seconds)	Average speed (mph)	Percent difference*
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41**	86.925	59.24	0.73%
General XP 2000 V4**	86.940	59.23	0.75%
Goodyear Eagle RS–A**	86.297	59.67	0.00%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**			
Firestone Firehawk PV41***	85.200	60.44	0.00%
General XP 2000 V4***	85.593	60.16	0.46%
Goodyear Eagle RS–A***	85.347	60.34	0.17%

* The percent difference is obtained by subtracting the average lap time of the tire of interest from the average lap time of the best scoring tire (lowest score is best) and dividing that number by the average lap time of the best scoring tire.

** Analysis showed no statistically significant difference between the Firestone and the General on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the Goodyear in this test (see Appendix).

*** Analysis showed no statistically significant difference between the Firestone and the Goodyear on the Ford Police Interceptor; there also is no statistically significant difference between the General and the Goodyear on the Ford; there is, however, a statistically significant difference between the Firestone and the General on the Ford in this test (see Appendix).


HIGH-SPEED HANDLING COMPARISON
1.43 MILE ROAD RACING TYPE COURSE
45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Average Speed in Miles Per Hour)

Tire Wear Measurements

Test Objective

Determine each tire's wear characteristics when subjected to the entire performance evaluation. Tread depth measurements are taken of the new right front tire of each test set of each brand, model, and size of tire tested. (New, for the purpose of this evaluation, means after a specific break-in procedure, but before any testing). The right front tire was chosen for these measurements because it typically exhibits the most wear in the test situations used in this evaluation. Tread depth measurements are taken for a second time prior to the final test phase, which is the high-speed handling evaluation. Finally, measurements are taken for a third time at the conclusion of the high-speed handling evaluation, which completes the testing.

Test Methodology

Following a specific tire break-in routine, but before any testing is done, tread depth measurements are taken of the new right front tire of each brand, model, and size of tires tested. The measurements are taken in four places across the tread of the tire, from outside to inside, and in four areas around the circumference of the tire, 90 degrees apart, for a total of at least 16 measurements per right front tire. These same right front tires are once again measured prior to the high-speed handling, and for a third time at the conclusion of the high-speed handling, which is the final test phase, to determine the total amount of tread depth lost during the entire test procedure. The average tread depth total is the average of all of the individual tread depths measured on a given tire. The final score for each tire will be the average tread depth of the right front tire that was worn away during the testing process.

The tire wear measurements shown in this report resulted from extremely severe operating conditions. As such, they may not be an accurate predictor of achievable tire mileage when used in normal police patrol service, and should not be used to extrapolate actual tire life.

Measurement Data

Tread Depth Measurements (all in inches)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Chevrolet Impala**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.273	0.324	0.324	0.272	
Following	Position 2	0.276	0.323	0.323	0.276	
Break-In	Position 3	0.283	0.325	0.325	0.275	
Procedure	Position 4	0.279	0.325	0.328	0.276	
	Averages	**0.278**	**0.324**	**0.325**	**0.275**	**0.300**
	Position 1	0.248	0.292	0.290	0.243	
Before	Position 2	0.251	0.292	0.291	0.251	
High-Speed	Position 3	0.253	0.293	0.289	0.249	
Handling	Position 4	0.255	0.292	0.290	0.247	
	Averages	**0.252**	**0.292**	**0.290**	**0.248**	**0.270**
	Position 1	0.211	0.237	0.250	0.206	
After	Position 2	0.210	0.240	0.252	0.209	
High-Speed	Position 3	0.213	0.238	0.254	0.209	
Handling	Position 4	0.213	0.232	0.251	0.211	
	Averages	**0.212**	**0.237**	**0.252**	**0.209**	**0.227**

Total Treadwear Resulting From Test Procedure **0.073**

Tread Depth Measurements (all in inches)

TIRE: **Firestone Firehawk PV41**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.281	0.327	0.326	0.274	
Following	Position 2	0.279	0.328	0.328	0.276	
Break-In	Position 3	0.280	0.328	0.328	0.276	
Procedure	Position 4	0.282	0.327	0.328	0.273	
	Averages	**0.281**	**0.328**	**0.328**	**0.275**	**0.303**
	Position 1	0.267	0.315	0.300	0.238	
Before	Position 2	0.261	0.298	0.302	0.247	
High-Speed	Position 3	0.258	0.308	0.300	0.253	
Handling	Position 4	0.267	0.304	0.301	0.249	
	Averages	**0.263**	**0.306**	**0.301**	**0.247**	**0.279**
	Position 1	0.226	0.258	0.260	0.208	
After	Position 2	0.234	0.256	0.258	0.211	
High-Speed	Position 3	0.229	0.248	0.250	0.216	
Handling	Position 4	0.234	0.258	0.256	0.210	
	Averages	**0.231**	**0.255**	**0.256**	**0.211**	**0.238**

Total Treadwear Resulting From Test Procedure **0.065**

Tread Depth Measurements (all in inches)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Chevrolet Impala**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.298	0.309	0.318	0.295	
Following	Position 2	0.298	0.314	0.315	0.294	
Break-In	Position 3	0.295	0.311	0.313	0.292	
Procedure	Position 4	0.295	0.313	0.317	0.292	
	Averages	**0.297**	**0.312**	**0.316**	**0.293**	**0.304**
	Position 1	0.280	0.281	0.273	0.258	
Before	Position 2	0.278	0.282	0.284	0.260	
High-Speed	Position 3	0.278	0.284	0.284	0.261	
Handling	Position 4	0.272	0.278	0.278	0.252	
	Averages	**0.277**	**0.281**	**0.280**	**0.258**	**0.274**
	Position 1	0.250	0.240	0.250	0.230	
After	Position 2	0.249	0.238	0.247	0.230	
High-Speed	Position 3	0.249	0.247	0.248	0.230	
Handling	Position 4	0.251	0.244	0.246	0.232	
	Averages	**0.250**	**0.242**	**0.248**	**0.231**	**0.243**

Total Treadwear Resulting From Test Procedure **0.061**

Tread Depth Measurements (all in inches)

TIRE: **General XP 2000 V4**
SIZE: **P225/60R–16 98V M&S**
CAR: **Ford Police Interceptor**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.295	0.309	0.311	0.287	
Following	Position 2	0.298	0.314	0.318	0.289	
Break-In	Position 3	0.295	0.310	0.310	0.289	
Procedure	Position 4	0.292	0.312	0.312	0.284	
	Averages	**0.295**	**0.311**	**0.313**	**0.287**	**0.302**
	Position 1	0.278	0.290	0.296	0.263	
Before	Position 2	0.281	0.290	0.300	0.275	
High-Speed	Position 3	0.282	0.291	0.295	0.266	
Handling	Position 4	0.278	0.296	0.296	0.263	
	Averages	**0.280**	**0.292**	**0.297**	**0.267**	**0.284**
	Position 1	0.256	0.262	0.260	0.240	
After	Position 2	0.257	0.259	0.265	0.244	
High-Speed	Position 3	0.259	0.257	0.260	0.241	
Handling	Position 4	0.257	0.262	0.259	0.244	
	Averages	**0.257**	**0.260**	**0.261**	**0.242**	**0.255**

Total Treadwear Resulting From Test Procedure **0.047**

Tread Depth Measurements (all in inches)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97H M&S**
CAR: **Chevrolet Impala**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.295	0.330	0.337	0.282	
Following	Position 2	0.292	0.332	0.338	0.286	
Break-In	Position 3	0.294	0.325	0.339	0.287	
Procedure	Position 4	0.289	0.325	0.339	0.283	
	Averages	**0.293**	**0.328**	**0.338**	**0.285**	**0.311**
	Position 1	0.263	0.293	0.304	0.249	
Before	Position 2	0.262	0.296	0.296	0.249	
High-Speed	Position 3	0.250	0.288	0.296	0.252	
Handling	Position 4	0.252	0.291	0.302	0.246	
	Averages	**0.257**	**0.292**	**0.300**	**0.249**	**0.274**
	Position 1	0.218	0.252	0.269	0.217	
After	Position 2	0.218	0.255	0.265	0.214	
High-Speed	Position 3	0.215	0.249	0.266	0.219	
Handling	Position 4	0.216	0.246	0.269	0.208	
	Averages	**0.217**	**0.251**	**0.267**	**0.215**	**0.237**

Total Treadwear Resulting From Test Procedure **0.074**

Tread Depth Measurements (all in inches)

TIRE: **Goodyear Eagle RS–A**
SIZE: **P225/60R–16 97V M&S**
CAR: **Ford Police Interceptor**

		Groove 1	Groove 2	Groove 3	Groove 4	Overall Average
	Position 1	0.283	0.341	0.345	0.282	
Following	Position 2	0.288	0.342	0.345	0.292	
Break-In	Position 3	0.288	0.339	0.344	0.282	
Procedure	Position 4	0.286	0.335	0.346	0.289	
	Averages	**0.286**	**0.339**	**0.345**	**0.286**	**0.314**
	Position 1	0.271	0.325	0.325	0.264	
Before	Position 2	0.268	0.325	0.328	0.268	
High-Speed	Position 3	0.268	0.321	0.327	0.265	
Handling	Position 4	0.272	0.320	0.322	0.260	
	Averages	**0.270**	**0.323**	**0.326**	**0.264**	**0.296**
	Position 1	0.219	0.249	0.270	0.229	
After	Position 2	0.220	0.248	0.269	0.232	
High-Speed	Position 3	0.217	0.252	0.266	0.238	
Handling	Position 4	0.215	0.249	0.269	0.230	
	Averages	**0.218**	**0.250**	**0.269**	**0.232**	**0.242**

Total Treadwear Resulting From Test Procedure **0.072**

Summary Test Data

Tire Wear Measurements (all in inches)
Overall Comparisons

	After Break-In (inch)	Before Handling Test (inch)	After Handling Tests (inch)	Average Wear Measured* (inch)	Total Treadwear** (percent)
CAR: **Chevrolet Impala** TIRE SIZE: **P225/60R–16**					
Firestone Firehawk PV41***	0.300	0.270	0.227	0.073	24.33%
General XP 2000 V4***	0.304	0.274	0.243	0.061	20.07%
Goodyear Eagle RS-A***	0.311	0.274	0.237	0.074	23.79%
CAR: **Ford Police Interceptor** TIRE SIZE: **P225/60R–16**					
Firestone Firehawk PV41****	0.303	0.279	0.238	0.065	21.45%
General XP 2000 V4****	0.302	0.284	0.255	0.047	15.56%
Goodyear Eagle RS-A****	0.314	0.296	0.242	0.072	22.93%

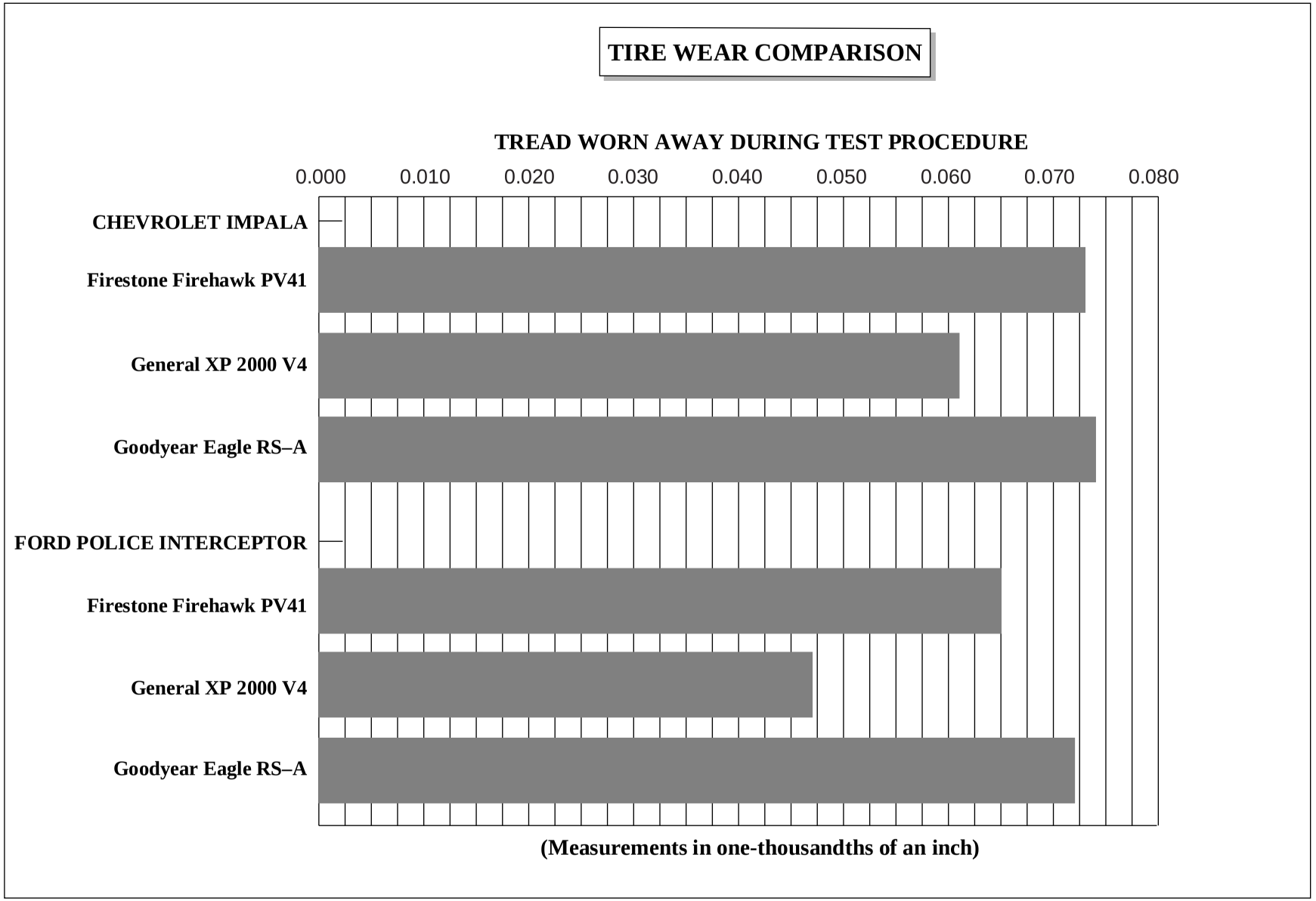
* To determine the average wear measured, subtract the "after handling test" tread depth from the "after break-in" tread depth. The resulting figure is the total amount of tread wear experienced during the entire test sequence.

Example: 0.317 inch – 0.262 inch = 0.055 inch

** To determine "total treadwear" percent, divide the "average wear measured" figure by the "after break-in" tread depth.

*** Analysis showed no statistically significant difference between the Firestone and the Goodyear on the Chevrolet Impala; however, there is a statistically significant difference between both of them and the General on this test (see Appendix).

**** Analysis showed statistically significant differences between each of the three tires on the Ford Police Interceptor (see Appendix).


TIRE WEAR COMPARISON
TREAD WORN AWAY DURING TEST PROCEDURE
0.000
0.010
0.020
0.030
0.040
0.050
0.060
0.070
0.080
CHEVROLET IMPALA
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
FORD POLICE INTERCEPTOR
Firestone Firehawk PV41
General XP 2000 V4
Goodyear Eagle RS–A
(Measurements in one-thousandths of an inch)

Overall Scores

All Test Categories

The following two pages contain the overall scores from each of the various test categories. The way they are presented is intended to assist the reader in making direct comparisons of the performance of the tires under various test conditions and on different makes and models of cars.

To most fairly compare the performance of the various tires, we have shaded some of the results to indicate when two or more tires are statistically equal.

When two of the three tires on a given test are within a shaded box, they should be viewed as having equal scores on that test, even though their numerical scores show a small difference.

Likewise, when all three tires are within a shaded box, there is essentially no difference between them, and they should be viewed as having equal scores on that test. (The reader should note that the tires within a shaded box may be equally better or equally worse on that test than the tire not in a shaded box.) In those categories where none of the scores are shaded, there are significant differences between each of the three tires tested.

Overall Scores All Test Categories

CAR: **Chevrolet Impala**
TIRE SIZE: **P225/60R–16**

Tire	Static circle dry (lateral "G")	Static circle wet (lateral "G")	Serpentine evaluation dry (mph)	Serpentine evaluation wet (mph)	Stopping distance dry (feet)	Stopping distance wet (feet)	High-speed handling (seconds)	Total treadwear from testing (percent)
Firestone Firehawk PV41	0.669	0.279	54.48	33.26	149.2	158.4	86.925	24.33
General XP 2000 V4	0.694	0.271	53.39	31.62	146.1	159.7	86.940	20.07
Goodyear Eagle RS-A	0.655	0.285	54.24	32.13	144.7	164.8	86.297	23.79

Overall Scores All Test Categories

CAR: **Ford Police Interceptor**
TIRE SIZE: **P225/60R–16**

Tire	Static circle dry (lateral "G")	Static circle wet (lateral "G")	Serpentine evaluation dry (mph)	Serpentine evaluation wet (mph)	Stopping distance dry (feet)	Stopping distance wet (feet)	High-speed handling (seconds)	Total treadwear from testing (percent)
Firestone Firehawk PV41	0.688	0.262	53.41	31.65	146.2	157.3	85.200	21.45
General XP–2000 V4	0.632	0.263	52.97	31.05	144.7	158.2	85.593	15.56
Goodyear Eagle RS-A	0.627	0.250	52.62	31.31	143.4	153.9	85.347	22.93

Epilogue

The test results may be used in two ways. First, they may be used as is to determine the tires that best meet the needs of your department. In this case, you should emphasize some portions of the evaluation to reflect the needs of your department. Second, the overall test results may be used to adjust the manufacturer's bid price for these tire brands.

The following pages contain a scoring and bid adjustment system that you may find useful in making decisions about your patrol vehicle tires. All the data used in the example are fictitious. Likewise, the category weights used are arbitrary. They should be adjusted to represent the actual conditions your agency faces and those factors important to you. The category weights should total 100. The example given is biased toward a dry climate, in which one may encounter wet roads infrequently. It could as easily have been biased toward wet road conditions, as might be encountered in the Pacific Northwest.

Scoring/Bid Adjustment Methodology

Step I—Raw Scores

Raw scores are developed, through testing, for each tire in each of the eight evaluation categories. The raw scores are expressed in terms of percentage of lateral G's, speed in mph, stopping distance in feet, time, or remaining tread depth.

Static circle -dry- (lateral "G")	Static circle -wet- (lateral "G")	Serpentine -dry- (speed)	Serpentine -wet- (speed)	Stopping distance -dry- (feet)	Stopping distance -wet- (feet)	High-speed handling (sec.)	Remaining tread depth (%)
0.763	0.702	63.92	34.12	151.64	159.44	91.724	0.982

Step II—Deviation Factor

In each evaluation category, the best tire's score establishes the benchmark against which each of the other test tire's score is compared. In the static circle and serpentine tests and the tire wear measurement section the highest score is best, whereas the lowest score is best in the stopping distance and high-speed handling tests. The best scoring tire in each test category receives a "deviation factor" of 0. The deviation factor is then calculated for the other tires by determining the absolute difference between each tire's raw score and the best score in the category. This difference is then divided by the best score, resulting in the "deviation factor."

Tire make and model	Serpentine -dry-
Tire A	63.92 0.021
Tire B	64.88 0.006
Tire C	65.26 0

Example:

Best score (Tire C)		Other tire score (Tire A)		Absolute difference		Best score		Deviation factor (Tire A)
65.26	–	63.92	=	1.34	÷	65.26	=	0.021

Step III—Weighted Category Score

The weighted category score of each tire is determined by multiplying the deviation factor (as determined in Step II) by the category weight.

Weighted Score	20	
Serpentine–dry–(speed)		
Raw score	63.92	
Deviation factor	0.021	0.021 x 20 = 0.420
Weighted category score	0.420	

Step IV—Total Weighted Score

The total weighted score for each tire is the sum of the eight weighted category scores for that tire.

	15	5	20	5	15	5	30	5	
Tire	Static circle -dry- (lateral “G”)	Static circle -wet- (lateral “G”)	Serpentine -dry- (speed)	Serpentine -wet- (speed)	Stopping distance -dry- (feet)	Stopping distance -wet- (feet)	High-speed handling (time)	Tread depth worn (%)	Total weighted score
Tire A	0.763	0.702	63.92	34.12	151.64	159.44	91.724	20.47	
	0.023	0	0.021	0	0.039	0.007	0.004	0.125	
	0.345	0	0.420	0	0.585	0.035	0.120	0.625	2.130

Step V—Bid Adjustment Figure

The bid adjustment figure that we chose to use in this example is 6 percent of the lowest bid price received. (This figure is arbitrary and may be adjusted upward or downward.) In this step and the following two steps, the lowest bid price received was $57.50 per tire, which results in a bid adjustment figure of $3.45.

Step VI—Actual Dollar Adjustment

The actual dollar adjustment for a tire is determined by multiplying that tire’s total weighted score by the bid adjustment figure.

Total weighted score	x	Bid adjustment figure	=	Actual dollar adjustment
2.130		$3.45		$7.35

Step VII—Adjusted Bid Price

The actual dollar adjustment amount for each tire is added to that tire's actual bid price. The tire with the adjusted low bid price would be purchased, provided all other bid conditions are met. (The amount paid for the purchased tires is the actual bid price.)

Actual dollar adjustment	+	Actual dollar bid price	=	Adjusted bid price
$7.35		$59.95		$67.30

Appendix—Analysis to Determine Statistical Significance

Summary of Static Circle Results

The static circle test was conducted under both wet and dry pavement surface conditions. For each condition, a number of combinations were tested using a single driver, two cars, and tires from three manufacturers. Each tire and car combination generated nine data points, each of which represents a lap around the static circle.

The base measurement for each data point is the elapsed time required to navigate 1 lap around the static circle. Based on the size of the circle and the elapsed time, a determination of lateral "G" force is made. G force is probably more recognizable to the readers of this report, and as such, this analysis includes basic statistics on this derived measure.

T-tests were run between pairs to determine specific differences. All analyses were done using a 95-percent level of significance.

Dry Static Circle—Chevrolet Impala

T-tests between pairs showed the following:

1. Firestone to General—General has significantly higher results.

2. Firestone to Goodyear—No significant difference.

3. General to Goodyear—General has significantly higher results.

Ranking:	Firestone	2
	General	1
	Goodyear	2

Dry Static Circle—Ford Police Interceptor

T-tests between pairs showed the following:

1. Firestone to General—Firestone has significantly higher results.

2. Firestone to Goodyear—Firestone has significantly higher results.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	1
	General	2
	Goodyear	2

Wet Static Circle—Chevrolet Impala

T-tests between pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—No significant difference.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	1
	General	1
	Goodyear	1

Wet Static Circle—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Firestone has significantly higher results.

3. General to Goodyear—General has significantly higher results.

Ranking:	Firestone	1
	General	1
	Goodyear	2

Summary of Serpentine Results

The serpentine tests were conducted under both wet and dry pavement surface conditions. For each pavement surface condition, a number of combinations were tested using a single driver, two cars, and tires from three manufacturers. Each tire and car combination generated 15 data points, each of which represents a run through the serpentine course.

The base measurement for each data point is the elapsed time required to navigate one trip through the serpentine course. Based on the length of the course and the elapsed time, a determination of miles per hour (mph) is made. Mph is probably more recognizable to the readers of this report, and as such, this analysis is based on this derived measure.

T-tests were run between pairs to determine specific differences. All analyses were done using a 95-percent level of significance.

Dry Serpentine—Chevrolet Impala

T-tests between pairs showed the following:

1. Firestone to General—Firestone was significantly faster.

2. Firestone to Goodyear—No significant difference.

3. General to Goodyear—Goodyear was significantly faster.

Ranking:	Firestone	1
	General	2
	Goodyear	1

Dry Serpentine—Ford Police Interceptor

T-tests between pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Firestone was significantly faster.

3. General to Goodyear—General was significantly faster.

Ranking:	Firestone	1
	General	1
	Goodyear	2

Wet Serpentine—Chevrolet Impala

T-tests between the pairs showed the following:

1. Firestone to General—Firestone was significantly faster.

2. Firestone to Goodyear—No significant difference.

3. General to Goodyear—Goodyear was significantly faster.

Ranking:	Firestone	1
	General	2
	Goodyear	1

Wet Serpentine—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—Firestone was significantly faster.

2. Firestone to Goodyear—Firestone was significantly faster.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	1
	General	2
	Goodyear	2

Summary of Stopping Distance Results

The stopping distance tests were conducted under both wet and dry pavement surface conditions. For each pavement surface condition, a number of combinations were tested using a single driver, two cars, and tires from three manufacturers. Each tire and car combination generated six data points, each of which represents maximum braking from target speeds of 60 mph.

The base measurement for each data point is the average rate of deceleration during the stop. The stopping distance is also recorded, however, this measure is affected not only by braking performance but also by the actual speed at the start of the test. This additional variability makes braking distance a poor measure for analysis. As such, only deceleration rate was considered in this analysis.

T-tests were run between pairs to determine specific differences. All analyses were done using a 95-percent level of significance.

Dry Stop Distance—Chevrolet Impala

T-tests between the pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Goodyear had a significantly higher average deceleration rate.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	2/1
	General	1
	Goodyear	1

Dry Stop Distance—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Goodyear had a significantly higher average deceleration rate.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	2/1
	General	1
	Goodyear	1

Wet Stop Distance—Chevrolet Impala

T-tests between pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Firestone had significantly higher average deceleration rate.

3. General to Goodyear—General had significantly higher average deceleration rate.

Ranking:	Firestone	1
	General	1
	Goodyear	2

Wet Stop Distance—Ford Police Interceptor

T-tests between pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Goodyear had a significantly higher average deceleration rate.

3. General to Goodyear—Goodyear had a significantly higher average deceleration rate.

Ranking:	Firestone	2
	General	2
	Goodyear	1

Summary of High-Speed Handling Tests

The high-speed handling test was conducted only under dry pavement conditions. The measure used for this test was elapsed time per lap of the course. Three drivers participated in this testing. Each drove the course for 5 timed laps with each of the three tires. The analysis is based on the four best runs for each driver and each tire. As such, a total of 12 runs were analyzed for each tire on each car.

T-tests were run between pairs to determine specific differences. All analyses were done using a 95-percent level of significance.

High-Speed Handling—Chevrolet Impala

T-tests between pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Goodyear was significantly faster.

3. General to Goodyear—Goodyear was significantly faster.

Ranking:	Firestone	2
	General	2
	Goodyear	1

High-Speed Handling—Ford Police Interceptor

T-tests between pairs showed the following:

1. Firestone to General—Firestone was significantly faster.

2. Firestone to Goodyear—No significant difference.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	1
	General	2/1
	Goodyear	1

Summary of the Tire Wear Measurement Results

Tire wear was assessed by measuring groove depth in the tread. The right front tire of the test set from each tire manufacturer and for each of the two vehicles was measured in 16 locations; 4 positions radially, and 4 positions across the tire, (4 tread grooves). The measurements were in .001 inch and were taken as follows:

1. Before any testing, but after a specific break-in routine.

2. After all testing except the high-speed handling portion, (see First Wear below).

3. After the high-speed handling test, (see Second Wear below).

Because the grooves are of different initial depths due to tread design and manufacturing process, the data that was evaluated was the wear between measurements. This serves to eliminate the effect of variable groove depth at the start of the test. Three sets of data were analyzed:

1. The wear incurred as a result of dry and wet static circle, serpentine, and stopping distance tests, but prior to the high-speed handling test (**First Wear**).

2. The incremental wear measured as a result of the high-speed handling test (**Second Wear**).

3. The total wear incurred after the break-in procedure through all of the testing (**Total Wear**).

T-tests were run between pairs to determine specific differences. All analyses were done using a 95-percent level of significance.

Before High-Speed Handling (Road Course)

First Wear—Chevrolet Impala

T-tests between the pairs showed the following:

1. Firestone to General—No significant difference.

2. Firestone to Goodyear—Firestone showed less wear than Goodyear.

3. General to Goodyear—General showed less wear than Goodyear.

Ranking:	Firestone	1
	General	1
	Goodyear	2

First Wear—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—General showed less wear than Firestone.

2. Firestone to Goodyear—Goodyear showed less wear than Firestone.

3. General to Goodyear—No significant difference.

Ranking:	Firestone	2
	General	1
	Goodyear	1

After High-Speed Handling (Road Course)

In general, the high-speed handling (road course) test generated more uniform wear across the tire than was experienced before the high-speed handling portion of the test. This outcome was to be expected since the high-speed handling test is more balanced and less tire wear biased than the other tests. This also gave a good general feel for the durability of all of the test tires in high-speed, pursuit-type driving.

Second Wear—Chevrolet Impala

T-tests between the pairs showed the following:

1. Firestone to General—General showed less wear than Firestone.

2. Firestone to Goodyear—Goodyear showed less wear than Firestone.

3. General to Goodyear—General showed less wear than Goodyear.

Ranking:	Firestone	3
	General	1
	Goodyear	2

Second Wear—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—General showed less wear than Firestone.

2. Firestone to Goodyear—Firestone showed less wear than Goodyear.

3. General to Goodyear—General showed less wear than Goodyear.

Ranking:	Firestone	2
	General	1
	Goodyear	3

Overall Wear Measurements

Total Wear—Chevrolet Impala

T-tests between the pairs showed the following:

1. Firestone to General—General showed less overall wear than Firestone.

2. Firestone to Goodyear—There was no significant difference in overall wear between the Firestone and the Goodyear.

3. General to Goodyear—General showed less overall wear than Goodyear.

Ranking:	Firestone	2
	General	1
	Goodyear	2

Total Wear—Ford Police Interceptor

T-tests between the pairs showed the following:

1. Firestone to General—General showed less overall wear than Firestone.

2. Firestone to Goodyear—Firestone showed less overall wear than Goodyear.

3. General to Goodyear—General showed less overall wear than Goodyear.

Ranking:	Firestone	2
	General	1
	Goodyear	3

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